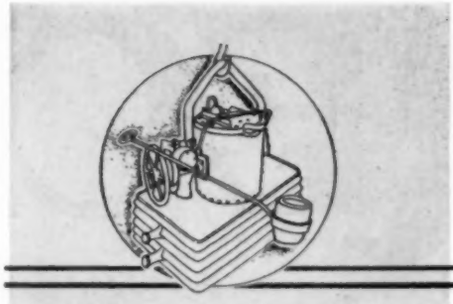

The Foundry

VOLUME 65 • NUMBER 11

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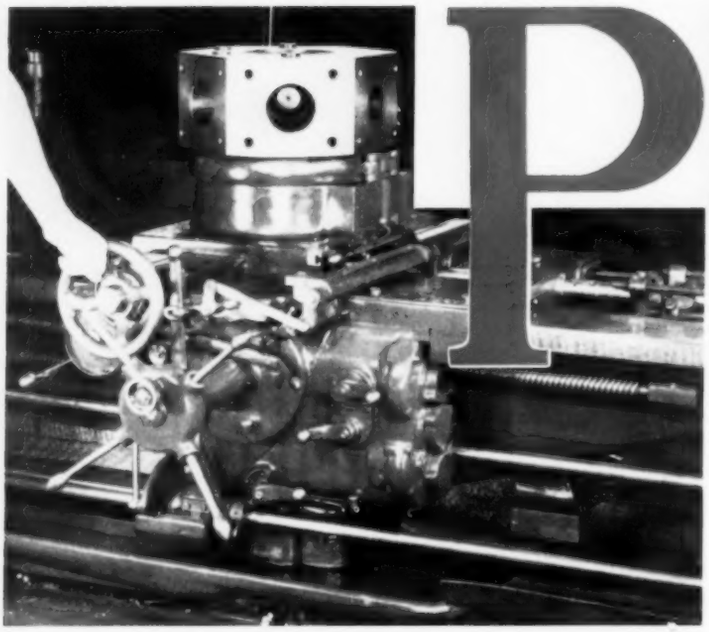
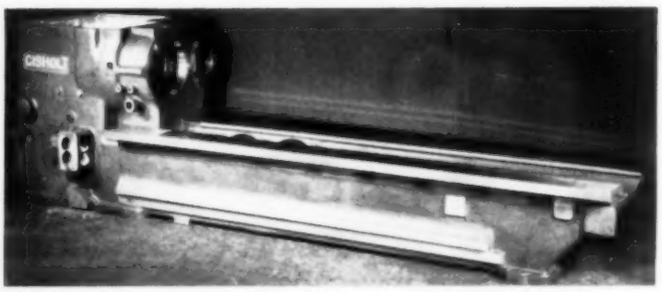


PRECI LI

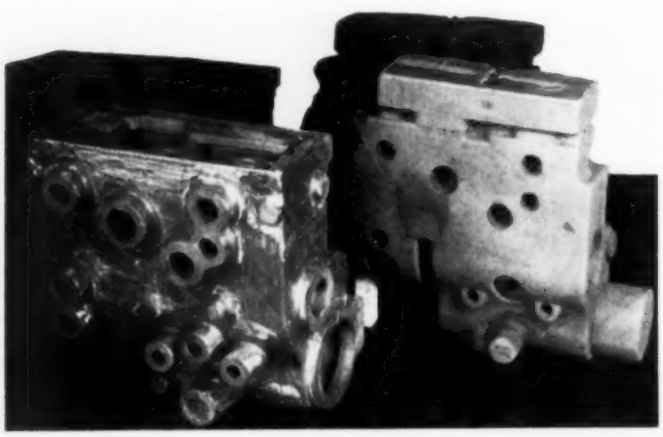
Every Detail Must be Exactly Right at

The Gisholt 5L Heavy Duty Turret Lathe bed and headstock casting at the right is 187 inches long, 48 inches high and weighs 8150 pounds. It is made in Linoil dry-sand mold and with Linoil cores. There are three smaller sizes, the smallest running 4800 pounds. Cast in one piece, nickel semi-steel.



"Core boxes clean out easily, cores dry uniformly and we get less smoke with your oil,"

SAYS GISHOLT SUPERINTENDENT



At left is apron casting and Linoil core. Casting has ⅝ inch walls, is 31 inches long and 21½ inches high and weighs 308 pounds. A similar apron casting is shown in picture at top of page attached to a cross feeding hexagon turret carriage of a Gisholt heavy duty turret lathe. Cast in Linoil dry sand mold.

THE WERNER G.

(Division of Archer-

The Foundry

Future Profits Depend On Present Policies

TEMPORARY hesitation in the recovery movement has resulted in rather spotty foundry operations. While agricultural shops are fairly busy and automobile foundries are active, the rushing business of early 1937 has been interrupted in many lines. With economists and politicians disagreeing among themselves and with each other on causes and probable trends, at least one fact appears certain. The pent up demand for both capital and consumer goods has only begun to be satisfied, and heavy buying is certain to follow the present interruption.

In the early part of the year when castings could not be made fast enough to keep up with customer demands, practically every foundryman realized the need for corrective measures. New equipment was needed to replace worn out and obsolete machines. Economy of time and money dictated the substitution of mechanical for hand methods. Other improvements in practice were apparent. Under existing conditions plants were too busy to initiate any radical changes.

Progressive foundrymen now are taking advantage of the present lull to plan and prepare for the next upward business surge. Such a policy will pay enormous dividends, not only in profits, but in customers well satisfied with deliveries and quality of product.

Will Influence All

OUR Washington editor points to a feeling in the capital that industry did not supply the last Congress with facts and figures needed for proper consideration of the wage-hour bill. On the other hand, labor organizations co-operated fully. This unconcern results from a feeling on the part of some that they will not be affected by the labor law, or that probably the legislation will not be enacted.

The bill will be the most controversial on the congressional program, with passage depending largely on efforts of industry during the next few weeks. While it probably is true some will not be regulated by a law based on the present proposals, the legislation carries certain dangerous provisions that will influence all sooner or later. Concerted action immediately should provide a law which is fair to both labor and industry.

Negative Publicity

WHY do some publicity minded governmental agencies so often create in the public mind a poor impression of methods or products of industry? Frequently, foundries are thus advertised. Many foundrymen are familiar with the lack of judgement on the part of one department in selecting photographs of foundry cleaning rooms for display at a recent exposition.

A few weeks ago, the office of education, department of interior, in co-operation with the Smithsonian institute, presented an interesting and instructive Sunday afternoon radio broadcast featuring development of the x-ray. Near the end of the program numerous applications of this valuable tool were dramatized, the first being the cleaning room of a foundry specializing in castings for aircraft. Sound effects provided atmosphere, with chipping hammers supplying the noise.

Of course, the intention was to impress the radio audience with the fact this modern instrument is used in the foundry. But alas, the casting being tested was pronounced defective, and therefore, some future accident was prevented. How easy it would have been for the script writer to have treated the unseen audience with the "discovery" of a perfect casting, one that was to give safety and service to air transportation.

Frank G. Steinebach
Editor

Cement

Used As Gray Iron

IN preparing a descriptive article on certain phases of practice in the foundry of the Chambersburg Engineering Co., Inc., Chambersburg, Pa., extensive makers of forging machinery, the temptation almost is irresistible to touch however lightly on some of the historical incidents connected with and romantic evolution of the art of forging in iron and steel.

However, in these modern days of hurryup reading it is possible that any reference of that kind would receive scant attention, and that attention of a resentful character. The impatient reader with thumb licked preparatory to turning the page would mutter to himself: Who wants to poke around in the ashes of cold forges, or who cares about old guys who either never existed, or have been converted into dust thousands, perhaps millions of years ago. I have heard all I want to hear about Tubal Cain and the other fella, just plain Cain; of Vulcan in the south and Thor in the north of Europe forging thunderbolts and scaring the lives out of the natives; of the village blacksmith, ha, ha, who swung the sledge with measured beat and slow under the spreading chestnut tree; of Charlie Martel, king of the Franks, who was known as the Hammer; of the cast iron anvil weighing 600 tons that was cast in Russia 50 years before that sleeping giant jumped out of bed one morning and threw the existing government and everything connected with it out the window.

The same reception probably would be accorded any reference to crude types of hammers actuated by power other than man power. With the possible exception of antiquarians and an occasional engineering student padding out a thesis on shop and forge practice, who is interested in the old beam hammers actuated by water wheels? What if these primitive and sturdy old thumpers did hammer out all the iron required by this young republic in the struggle for independence and for many a long year afterward? Who cares whether James Nasymth or Johnny Holtott invented the steam hammer and thus revolutionized forging practice by harnessing one of the greatest giants of this or any other period?

That stuff is all ancient history. Water over the dam. Forget it. What are the people doing at Cham-

Fig. 1 (Above)—The mold is made up of a number of cement bonded sand cores assembled in a pit in the floor. Fig. 3 (Right)—Section of core room floor on which inside and outside cores are set up to dry

By PAT DWYER

Binding Agent In Foundry

Fig. 2—Typical pit mold in which cement bonded sand replaces ordinary facing sand. Routine practice is followed in making the mold

bersburg that differs from what other foundrymen are doing all over the country?

Replying to these various courteous inquiries in the same spirit in which they are asked, the answer is, plenty.

For nearly half a century the company has been engaged in the manufacture of power hammers of every description. Ever alert to changing conditions and with proper manufacturer's pride to keep in the forefront of the industrial procession, it is only natural to find that shop technique and metallurgical improvements have kept pace with and in many instances have anticipated actual requirements of customers. In recent years this progressive spirit has been reflected in the development of special alloy irons designed to prolong the life and increase the efficiency of hammer and anvils. The most recent innovation is the introduction of the so called Randupson process for making the molds in the foundry.

The basic feature of this process, first developed in France and introduced to this country by the Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa., is that portland cement is used as a binding agent for the sand. A general description of the process as applied to the production of steel castings was presented in a series of four articles which appeared in THE FOUNDRY, Dec., 1935 and Jan., Feb., and March, 1936. In the application of the process to the manufacture of gray iron castings, the Chambersburg Engineering Co., developed a technique which differs to some extent from that employed in the steel foundry.

Close control is exercised over the sand, particularly the moisture content which is held between 6 and 7 per cent. Thus in warm weather when the humidity in the atmosphere is high, the moisture content in the batches may vary between 6.8 and 7.2 per cent. In colder weather the moisture content is held to between 6.2 and 6.8 per cent. New sand in the facing fixture is a silica sand without bond of any kind as it is received from the producer. In the storage bin the moisture content of this sand ranges between 0 and 2 per cent. Cognizance of this factor is taken into account in preparing the mixture. The proper amount of water is added to bring the mixture up to standard.

Facing sand is mixed in a roller type pan mill or

muller made by the National Engineering Co., Chicago. Each batch of material contains 800 pounds of sand and 1 bag or 96 pounds of cement and of course the required amount of water. Experiments have been tried with other proportions of sand and cement, but the mixture as now standardized serves most satisfactorily. In addition to the sand and cement, and this is where the mixture differs radically from the facing used in steel foundries, sea coal to the extent of one 50-pound bag is added to each batch. Apparently the sea coal in the cement facing has the same effect as sea coal in ordinary sand facing.

Sand in the facing is not all new sand. Experience has shown that reclaimed sand can be added to the mixture up to a maximum amount of 60 per cent. Sand is reclaimed and reconditioned in an extensive piece of equipment supplied by the Jeffrey Manufacturing Co., Columbus, O.

Many of the molds are made in flasks as in ordinary dry sand molding practice. A considerable number, and this includes all the larger and heavier castings, are molded in pits in the floor. After the castings have cooled, the flasks are shaken out over a section of the floor in the vicinity of the sand reclaiming apparatus. The larger castings are lifted out of the pits, and later, the sand which surrounded them is lifted by grab bucket and conveyed to the same location. Some of this sand is in a fairly pulverized condition, but the greater part is in lumps ranging in size from that of a marble to pieces as large as paving blocks.

Lumps Are Broken Down

A grab bucket suspended from a crane feeds this material into a hopper above a hammer type breaker which reduces the lumps to grain size. A long screw conveyor carries this material to the boot of a bucket elevator which discharges into an overhead storage tank. From the tank the material falls through screens into a number of steel hoppers with discharge gates at the bottom and at a sufficient height above the floor to accommodate the trucks or wheelbarrows employed in carrying the material to the sand mixers. Material that will not pass through the screens is delivered through a suitable chute and hauled away to the dump. In the screening process, a considerable amount of fines, in this instance mostly cement dust, is recovered, but up to the present no application has been found for this substance.

Most of the sand at the shakeout station does not pass through the reclamation apparatus. The treatment is not necessary. A considerable amount simply is wet down and utilized as backing sand in the molds. Part of the remainder, large and small lumps, take the place usually occupied by coke beds under molds and in the interior of large cores. The remainder is loaded periodically and hauled away to the dump. Sand is cheap and plentiful in this part of the country, and the working supply (*Please turn to page* 80)

Fig. 4 (Top)—Mold for airplane fuselage die gated to fill the mold rapidly. Fig. 5 (Center) and Fig. 6 (Left)—Machine tool castings as they appear when taken from the sand, showing clean skin and smooth, straight walls

Invisible Shrinkage In Castings

By HARRY A. SCHWARTZ
Manager of Research
National Malleable & Steel Castings Co., Cleveland

MUCH has been said by others as well as by the present writer regarding the effect, in the form of a cavity, produced when the hot liquid interior of a casting cools through a longer temperature range than the quickly frozen skin[1]. It is even possible to discuss what the shape of such a cavity must be if the freezing metal is deposited as a series of successive layers on the inner surface of the outer, frozen walls.

All foundrymen will remember cases where castings can not be found to contain any open cavities but only spongy areas and, more rarely, where even such sponginess is, if not absent, at least not to be found. There seems therefore some reason to discuss not why castings shrink but rather why they do not shrink, at least visibly.

Determine Density of Pieces

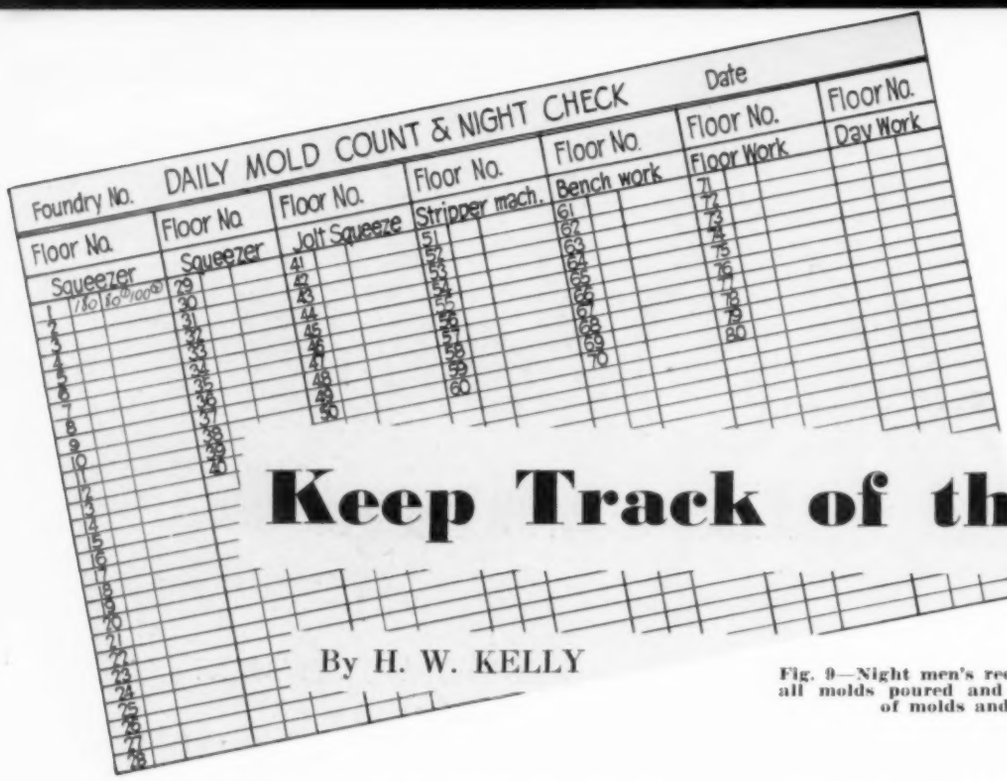
That this phenomenon is real and not an illusion is well shown by certain observations which have lately come under the writer's attention as part of a research into an entirely different matter. Certain spherical castings, about 2½ inches in diameter, were made from a great variety of irons by a gating method calculated completely to avoid feeding[2]. There was occasion to examine a number of these by radiographic methods and 13 were found in which no visible defects existed. The density of each of these as a whole was determined by the Archimedean method (loss of weight in water). Another ball from the same gate was broken up and the soundest pieces selected, showing no shrinkage at all. These pieces were broken down to fragments a few millimeters in diameter. The density of these fragments was determined in the pycnometer. As described in the reference, the difference in density is a measure of the percentage of voids. The actual results are shown in the accompanying table.

To the extent that statistical mathematics may be applied to so small a group of figures the indications are that the observed average difference is so small in comparison with the standard deviation (scatter) that the chances are about 4 in 5 that it is due merely to chance and is not a real difference. In other words, the density of the metal in a ball presumably containing voids of some sort equivalent to the shrinkage cavity is not definitely different from the density of the same metal in as sound a state as we can select. The only explanation is, of course, that the balls have the voids present not as well defined macroscopic cavities but in almost microscopic and uniformly distributed porosities.

The answer lies in the type of freezing characteristic of white cast iron in common with many other alloys. When cast iron begins to freeze the solid which appears first is far lower in total carbon than the metal as a whole. The first freezing metal arranged itself throughout the liquid in a pattern suggesting the trunk, branches and twigs of a pine tree, a so called dendritic pattern. As the temperature falls these branches grow, slowly becoming richer in carbon but always lower in carbon (about 1 to 2) than the surrounding liquid. When the eutectic melting point, about 1130 degrees Cent. (2065 degrees Fahr.) is (*Please turn to page* 90)

Tests Show Shrinkage

Density of Ball	Density of Fragments	Difference
7.724	7.751	0.027
7.721	7.723	0.002
7.704	7.749	0.045
7.726	7.733	0.007
7.722	7.727	0.005
7.717	7.726	0.009
7.639	7.672	0.033
7.690	7.662	—0.028
7.711	7.725	0.014
7.746	7.725	—0.021
7.715	7.711	—0.004
7.704	7.676	—0.028
7.726	7.688	—0.038
		Average, 0.002—



Keep Track of the Costs

By H. W. KELLY

Fig. 9—Night men's record sheet gives complete information of all molds poured and not poured during the day, the class of molds and flasks, and other information

This is the second of three articles on costs prepared by the author. The first appeared in the October issue of THE FOUNDRY

IN PRODUCING castings weighing from a few ounces to 200 pounds, the majority of the patterns will be mounted on matchplates and the molds will be made on air squeezing machines. Other machines required will include a number of jolt squeezers, stripping plate machines and jolt rollover machines. Squeezer machines may be confined to one side of the foundry where the floors are numbered from 1 to 40. Jolt squeezer machines are on another side of the shop on floors numbered from 40 to 50.

Floors between 50 and 60 are equipped with the heavier stripping machines. Small loose patterns are molded on benches on the floors between 60 and 70 while miscellaneous light floor work is molded on the group of floors between 70 and 80. Orders and office information are greatly simplified by this method of numbering the floors. Any given number indicates what class of work is running on any particular floor.

Order forms issued to the foundry foreman from the office are shown in Fig. 14 and carry the following itemized information: Customer's name, quantity required, pattern number, date wanted, how made (machine) size of flask, difficulties if any on last order, molding price, core price, date of first shipment, floor on which pattern was used last, how castings are to be cleaned. This information also is entered in the molder's daily book. This book is shown in Fig. 13 and forms a (*Please turn to page* 84)

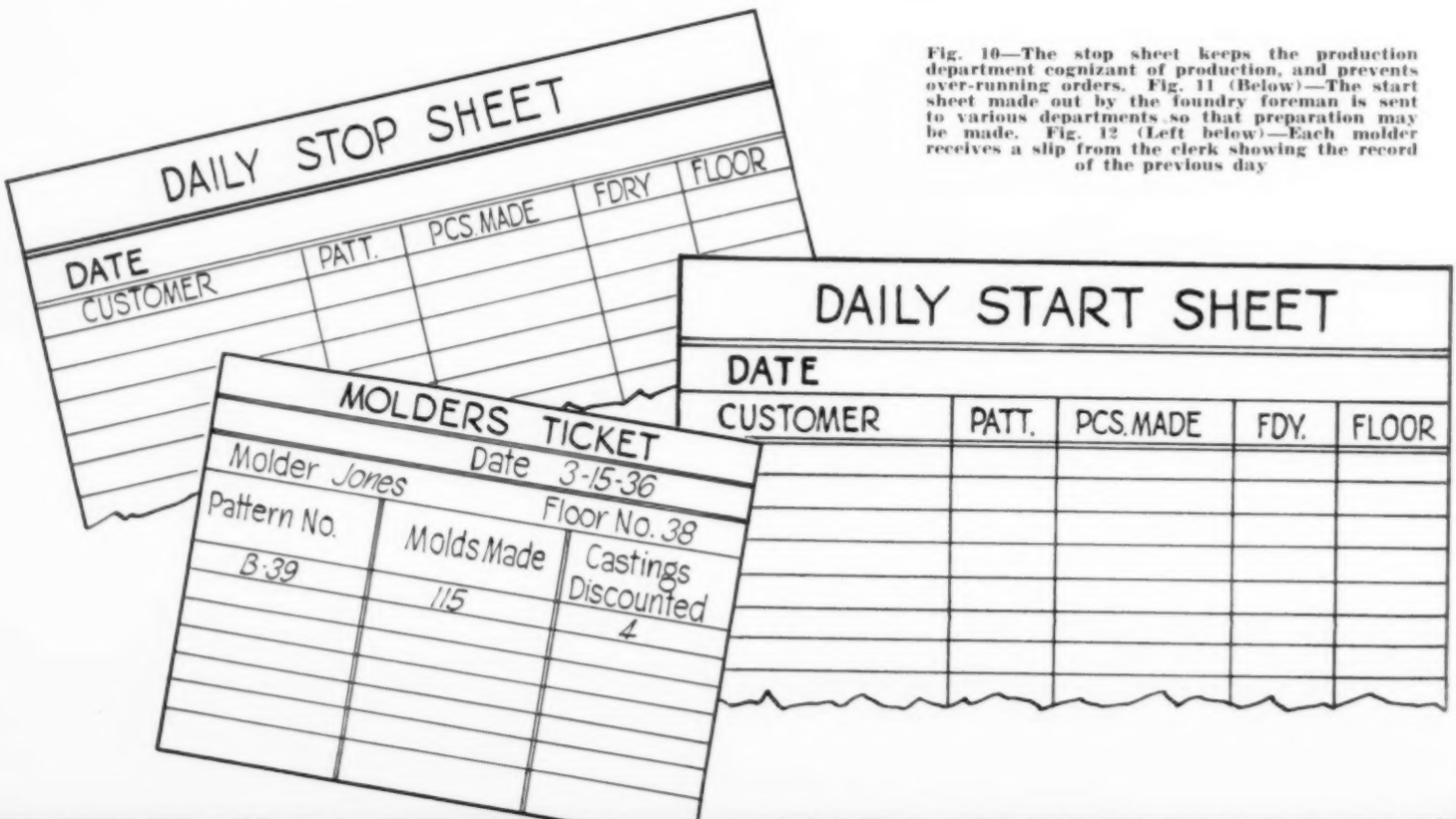


Fig. 10—The stop sheet keeps the production department cognizant of production, and prevents over-running orders. Fig. 11 (Below)—The start sheet made out by the foundry foreman is sent to various departments so that preparation may be made. Fig. 12 (Left below)—Each molder receives a slip from the clerk showing the record of the previous day

Control Basic Open-Hearth Practice

By JOHN W. PORTER

Assistant Works Manager
American Steel Foundries, Granite City, Ill.

This article is abstracted from a paper presented at the regional conference held at Rolla, Mo., under the joint sponsorship of the Missouri School of Mines and Metallurgy, the St. Louis District Chapter of the A.F.A. and the American Foundrymen's association

THE first basic open hearth heat as produced at the Granite City Works of the American Steel Foundries, Granite City, Ill. was in 1894. Subsequently, six 25-ton furnaces were built and employed till 1931 when the cumulative improvements in open hearth practice dictated complete rearrangements of that department.

There are three basic furnaces in use at the present time into each of which 30 tons generally are charged and refined. The furnaces are known as the Stevens type and are encased with steel plate on the outside, with the exception of the roof. Between the plate and the brickwork, insulation is employed.

Assuming the furnace is complete mechanically and structurally, a small wood fire is started in the stack and in front of each furnace door with the reversing valves set in the center to pull both ways to the stack. Care must be taken that the flames do not come in contact with the walls or the roof of the furnace.

As the furnace dries out, the fire is built up to cover the furnace bottom and continued about 72 hours. Fuel oil is not turned on until the walls begin to show a reddish color. At the time fuel oil is turned on the furnace, and the consumption is held as low as possible with a maximum consumption of 50 gallons per hour.

Care must be taken that the furnace bottom is clean when the fuel oil is turned on the furnace. When the fuel oil is turned on the furnace, the reversing valves are taken off center, and the furnace is reversed after one hour. The time of reversals is cut down gradually until at the end of about 48 hours the time of reversals is 15 minutes.

It is important that the temperature of the furnace be increased gradually, with a minimum of 48 hours to bring the furnace to working temperature. Having been brought to the proper temperature, the work of building the bottom is started.

Double burned magnesite is employed for all new furnace bottoms. Magnesite is used because it generally is purer than dolomite and has a higher melting point. Furthermore, it does not slack as quickly if the furnace is not operated for a period. The magnesite is mixed with ground basic slag in the proportion of three parts magnesite and one part slag. This mixture will be referred to as *magnesite mix.*

It is important to select slag free from steel and ground as fine or finer than the double burned magnesite. No other bonds of any nature are used with these materials. A coating of slag is placed on the brickwork before any magnesite mix is used. The material should be spread over the furnace bottom as evenly as possible with layers not over ¼-inch thick, and sufficient time allowed for the material to sinter properly before the next layer is placed in the furnace.

For the first 3 inches of bottom placed in the furnace, an interval of not less than 2½ hours elapses before the next layer is placed in the furnace. After the bottom is 3 inches thick, tests are made at least three times in 24 hours, by shutting off the fuel oil, allowing the bottom to cool for 30 minutes, and striking the bottom with the end of a rod to test the solidity of the material in place.

After the bottom has been built up, until it is about

3 inches thick, about 12 samples of the bottom are obtained in 24 hours by a rod properly equipped. After cooling, these samples are broken and the fractures examined for solidity.

The mixture of three-fourths magnesite and one-fourth slag is used on side walls exclusively. Some slag will flow out of the mixture to the furnace bottom. Magnesite without slag is used to fill in the furnace bottom and absorb this excess slag. The proportion of slag in the mixture should be adjusted to produce a solid bottom.

The practice of taking samples is continued until the bottom is complete. The layers of magnesite mix are continued until the level of the tapping hole is reached. The time necessary to build a bottom in a 30-ton basic open hearth furnace is about 6 days.

Making the Furnace Bottom

A pipe 6 inches in diameter and of the proper length is placed in the proper position for the tapping hole and held in place by blocking where the tapping hole passes through the wall of the furnace. The part of the pipe inside the wall of the furnace is covered with a layer of magnesite mix 1 inch thick, and the end which extends inside the furnace bottom line covered with magnesite mix to prevent the pipe melting. The pipe is closed by filling the inside with either magnesite or burned dolomite, as though it were closed for a heat.

The layers of magnesite mix are continued up the side of the furnace to a point about 10 inches above the slag line. The furnace bottom is arranged so that the steel and slag will all drain out of the furnace when the tap hole is opened.

On the tapping hole where the pipe was blocked in the furnace wall to keep it in position, the brick used for blocking is removed and replaced with a mixture of three parts of gannister or chrome, and one part of clay, with enough water to make the mixture pack well. This mixture is rammed as hard as possible, and the space between tapping hole casting and pipe in the wall of the furnace completely filled. The tapping hole is cleaned out and reclosed as though a heat were to be charged.

Ground slag is charged into the furnace, placing this as high as possible on the sides of the furnace, using the same methods used to place material for the bottom. This is repeated after approximately one hour and continued until there is a depth of 2 to 6 inches of liquid slag on the furnace bottom. The liquid slag is splashed as high as possible on the walls and ends of the furnace to allow the magnesite to absorb as much as possible of this liquid slag. The time allowed for this slagging bottom should not be less than 5 hours.

The slag is then tapped and the furnace is ready for the first heat. Before charging the furnace, the furnace bottom is chilled by opening the doors and cutting off the fuel.

The tapping hole is closed by holding a rabble against the end in the furnace. Bottom material is inserted from the outside and firmly packed in place until the tap hole is filled to about 6 inches from the end. This space is filled with loam moistened with sufficient moisture to make it pack well. The rabble is removed from the inside of the tap hole and some bottom material placed over the end of the tap hole by shoveling through the door of the furnace.

The furnace runner is lined with clay brick and then mudded with loam moistened with water to the proper consistency so that it packs well. This mud is renewed after each heat. The runner is dried to remove all moisture before the heat is tapped.

Gives Standard Metal Charge

In making up the furnace charge, consideration should be given to the material on hand, chemical analysis, price, and space required in the furnace. In arranging the furnace charge the standard indicated in the accompanying table is sought. Burned lime is used in place of limestone for two reasons—(1) the time element in melting, and (2) the need for less initial carbon content in charge. Additional lime may be added to bath when necessary to condition the slag.

Material in the charge is charged in the following order: (1)—Scrap, (2)—Petroleum coke and manganese ore, (3)—Lime, (4)—Scrap, except rails, (5)—Rails, and (6)—Pig iron. The first material charged into the furnace on each heat is selected with a purpose of covering the bottom of the furnace and furnishing a bed for the lime. This will prevent the lime from sticking to the furnace bottom. Plate scrap is probably the best for this purpose. Lime should be spread over the first scrap charged as evenly as possible.

The furnace is arranged with two sources of draft—a fan to force air into the furnace, and a stack to draw air out of the furnace. Amount of air admitted to the furnace is controlled by the diaphragm, which also controls the fuel oil. The stack is provided with a damper and manometer, so that the proper conditions and balanced pressure can be maintained in the furnace.

Draft in the furnace at the downtakes is about 0.07-inch on the outgoing end, and about 0.05-inch on the incoming end. It is necessary to have a slight plus pressure in the furnace to avoid cold air entering the furnace. When the final additions are made, the draft is reduced to 0.04-inch in the stack.

The fuel oil and steam are (*Please turn to page* 86)

Standard Charge Practice

Material	As Charged Per cent	As Melted Per cent
Carbon	1.75 to 2.0	0.65—0.75
Manganese	1.40 to 1.50	.....
Silicon	Max. 0.50	0.03
Sulphur	Max. 0.045	.....
Phosphorus	Max. 0.065	.....

A typical charge is as follows:

Material	Pounds	Per cent
Pig iron	12,000	20.0
Own and company	6,000	10.0
Plate scrap	22,500	37.5
Rails	11,000	18.5
Forgings	4,500	7.5
Springs	4,000	6.5
Total	60,000	100.0

Material	Pounds
Tar coke	300
Burned lime	2600
Manganese ore	600

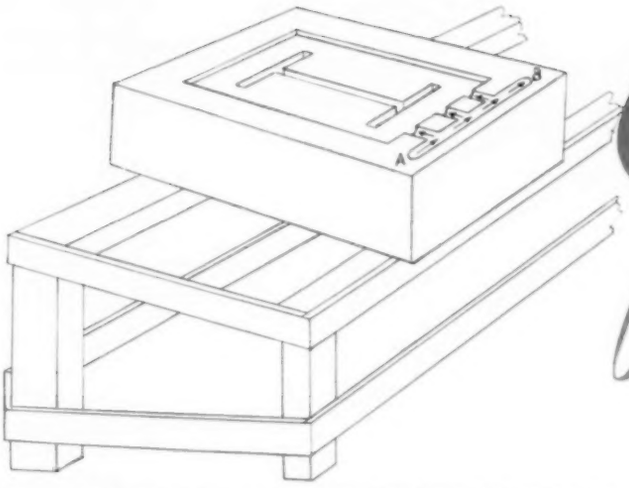


Fig. 9—Molds are set on a slant so that the metal gradually may rise. Entering at A the metal first flows down the runner to B to trap any dirt

Gating Nonferrous Castings

By N. K. B. PATCH

RED brass castings, such as alloy 85-5-5-5, and 77-3-10-10, require a type of gating somewhat different from the yellow brass alloys. Red brass alloys, higher in copper and very much lower in zinc are not so viscous or sluggish; particularly when an appreciable amount of tin is present. Where the tin is down 2 or 3 per cent and the zinc is as high as 10 per cent, there is some tendency to develop zinc smoke. Consequently the conditions begin to approach those of yellow brass. Presence of zinc smoke means the need for more rapid filling of the mold and more forceful pouring.

Where an alloy like 85 per cent copper, 5 per cent tin, 5 per cent lead, 5 per cent zinc, has been melted properly in the furnace, it will run readily into the mold through properly designed sprues, runners and gates, without forceful pouring, but with a nice quiet, steady stream. Several streams entering a mold will unite readily. They do not tend to form seams so easily as yellow brass unless the pouring temperature is excessively low.

Metal Should Enter at Bottom

When poured at the right temperature these alloys will run freely. The gating system should lead the metal into the mold cavity quietly and preferably from the bottom toward the top. The last metal supplied to the mold should be closest to the riser, which then receives the hot metal and, consequently, is the last to be filled and the last to solidify, resulting in the definite feeding of molten metal from the riser to the casting.

In most instances in these alloys the runner must be located in the drag or nowel of the mold. The gates connecting the runner with the casting are in the cope. A steady persistent stream of metal should be maintained and the sprue should be of a size to maintain the proper flow of metal to the mold and yet be kept full throughout the entire pouring period.

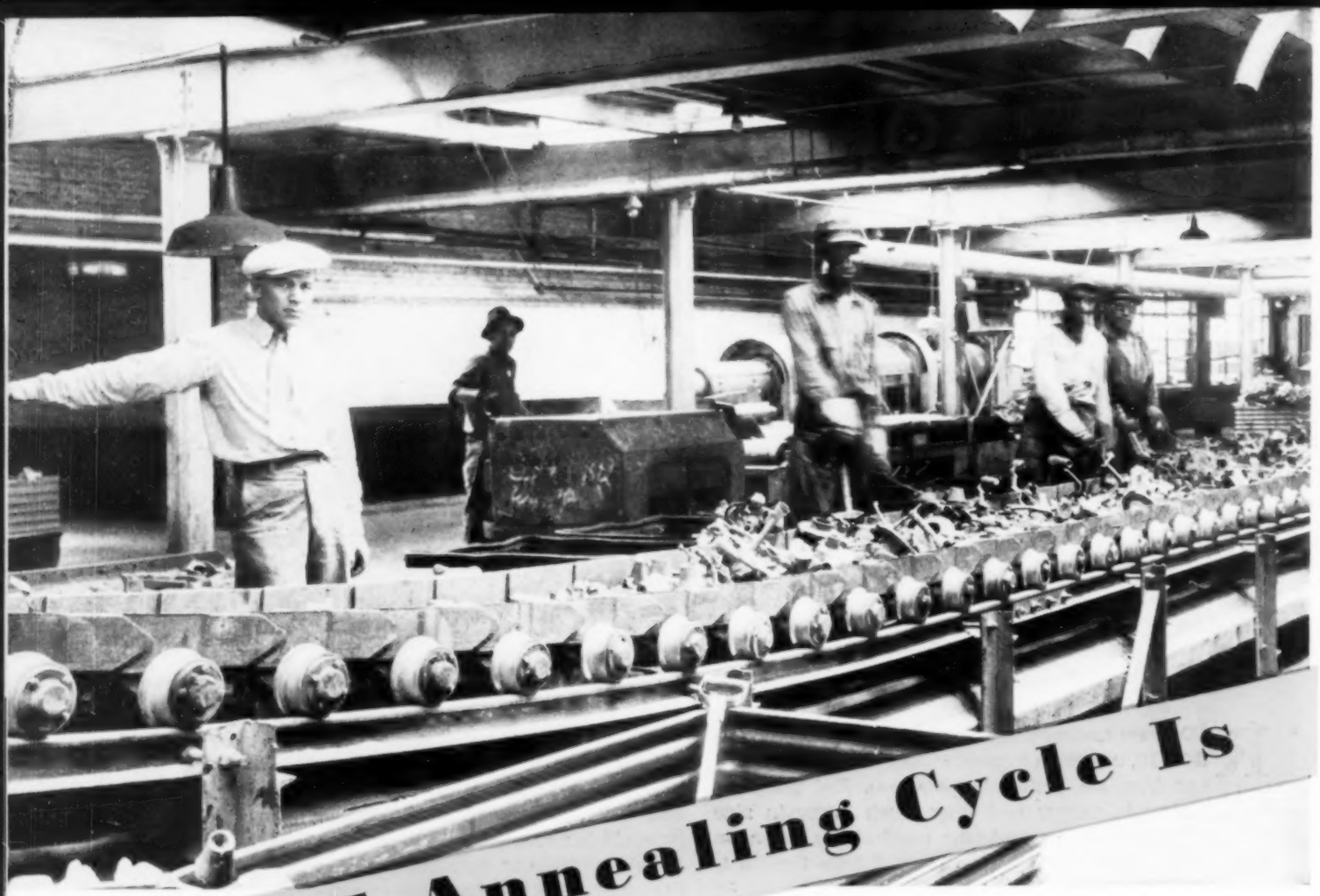
Since this type of alloy tends to shrink a little more than some of the yellow brasses, risers must be somewhat larger and the gate connecting the riser to the casting must be of such a size as to definitely insure its non-solidification until after the casting has been fed. Where heavy sections are present, provision should be made for the necessary riser to feed them. It will be found desirable to gate the casting so that the metal first enters the riser and then passes from the riser to the mold. The riser must be high enough to definitely insure sufficient pressure to force the molten metal into the casting as feeding is needed.

Chills Take Place of Risers

Chills may be used in some instances to cause rapid cooling of heavy sections. Where these heavy sections cool with the lighter sections adjoining the risers may be eliminated on the heavy sections. However, this, is merely a substitute for the better and sounder practice of feeding through a riser. Chilling only is resorted to when it is very difficult or impossible to attach the necessary risers. Chills usually are bronze or iron.

In some instances where the part to be chilled is very small, a number of nails are pushed into the mold so that the head contacts the casting and thus acting as a chill carries away some of the heat. All chills are potential sources of blows and consequently may be more disastrous than corrective. When they are successful in correcting the shrinkage conditions they are satisfactory. If they cause blow holes, the castings must be rejected. Therefore, risers are safer and sounder for taking care of shrinkage in heavy sections of castings.

Through the friction of the metal passing through them long runners or gates tend to quiet down the rush of metal into the mold. However, this very friction tends to erode or remove some of the sand from the runner or gates and it may be carried into the mold. The speed or quietness of the metal stream is controlled much better by the size of the sprue or by a restriction at some point in the runner or gate to insure the proper rate of travel for the metal entering (*Please turn to page* 89)



Rapid Annealing Cycle Is

IN PREVIOUS articles relating to the Saginaw Malleable Iron division, General Motors Corp., Saginaw, Mich., which appeared in the September and October issues of THE FOUNDRY, repeated references are made to the application of technical control to various operations. Exercise of that technical control has been extremely beneficial, and has led to many improvements and developments all along the line in the production of malleable cast iron.

Some of those relating to core sand and core making, molding sand and molding methods, and to duplex melting have been mentioned and described in the previous articles. Others include studies of pig iron characteristics and production which made possible accurate specifications for the most suitable pig iron, investigation of coke that resulted in a combustibility-rate method of ascertaining the most desirable coke, and more recently aiding in the application of a radiant tube, continuous type, gas-fired furnace to annealing malleable cast iron in a 30-hour cycle.

The latter is of especial interest because, at the present time, it is the only unit of its kind producing a regular, commercial malleable cast iron in so short a period. In addition to that furnace, the firm also anneals castings in 4 tunnel kiln-type, continuous furnaces on a 59-hour cycle, and the improvements in that type of furnace which enabled use of such a reduced period as compared to usual 100-hour cycle, were the result of study and investigation by the technical staff of the Saginaw Malleable Iron division.

Castings Cooled in Transit

However, before proceeding with a detailed description of the radiant tube annealing furnace, it may be well to follow the progress of the castings from the shakeout to the annealing department. At the shakeout, the cooled molds are pushed from the tables of the mold conveyor by a pneumatic ram onto a rapidly vibrating shakeout screen. The sand falls through the screen to a belt conveyor system which carries it to a storage hopper in the sand preparation department which was described previously in the October issue. The empty cope and drag flasks are removed from the screen and hung upon their proper conveyor chains to be carried back to the molding stations while the still hot castings fall on a sloping chute.

The sloping chute carries the castings to perforated steel baskets or buckets suspended from an overhead conveyor chain. The baskets and conveyor form the cooling system, and travel outside the building for

Fig. 14 (Left)—Small castings are sent through the continuous tumbling barrel shown in the background, and then discharged onto the long apron conveyor

Feature of Malleable Plant

By EDWIN BREMER

a considerable distance to obtain more effective cooling. Speed of travel can be regulated so that from shakeout to cleaning room the castings are allowed to cool from 45 minutes to 1 hour and 15 minutes depending upon the atmospheric conditions, size of castings, etc.

In the cleaning room the contents of the baskets are dumped on one of two conveyor belts—small castings on one, large castings on the other. The small castings are sent through a continuous tumbling barrel shown in the background of Fig. 14. From the tumbling mill the castings are discharged onto the long apron conveyor shown in the center of Fig. 14. Men stationed along that conveyor knock off the gates and sort the castings into steel tote boxes mounted on skids, which may be observed in the illustration. The sprues are left on the conveyor which carries them to a vibrating screen to remove any adhering sand. This material then is discharged into tote boxes which are taken to the cupola charging platform.

Large castings are placed on a separate belt conveyor, and as they move forward, men stationed along the sides of the belt knock off the sprues and gates, and sort them into tote boxes. As in the case of the small castings, the sprues, etc. from the large castings remain on the belt, pass over a vibrating screen into tote boxes, and are sent to the cupola charging platform. The sorted and inspected castings, both large and small, are transported to the annealing department where the castings are heat treated in one or the other of two types of furnaces.

The tunnel-type continuous kilns for annealing castings are about 360 feet long, and are gas-fired. Castings annealed in the furnaces are loaded into regula-

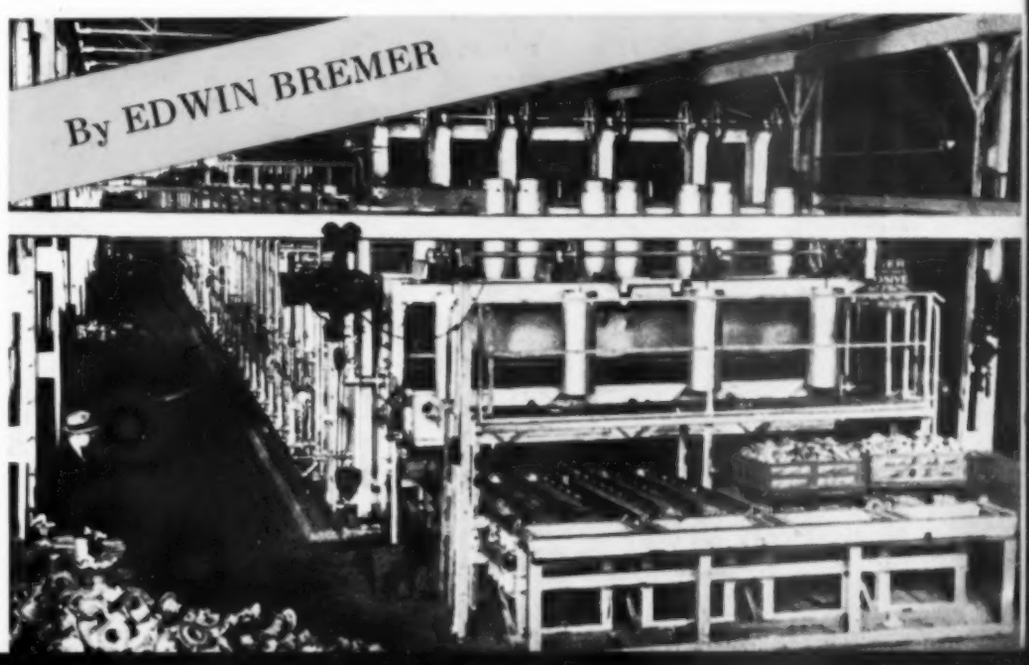


Fig. 15 (Right)—Radiant tube annealinge furnace is 20 feet wide and 115 feet long, and has vestibules at each end with inner and outer doors arranged to prevent infiltration of air. Atmosphere in the furnace is controlled, and aids in reducing annealing time and prevents scaling of castings. The furnace is divided into four zones of accurately controlled temperature conditions

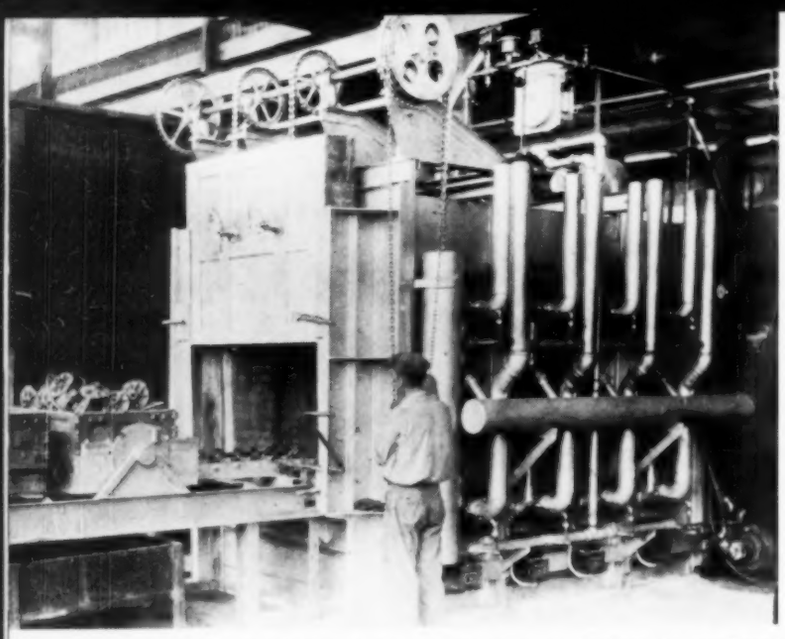


Fig. 16—Small batch type, radiant tube furnace is employed for heat treating pearlitic malleable cast iron

tion annealing pots which are transported through the furnaces on small cars. The cars have refractory tops containing flues underneath the loaded pots so as to obtain better circulation and distribution of the heating and cooling gases.

The cars are about 6 feet long and 6 feet wide and hold 24 of the regular 16 x 24-inch rectangular annealing pots. The latter are arranged in two rows of pots, three wide, and stacked four high. Each pot contains about 350 pounds of castings, and consequently each loaded car carries approximately 4 tons of castings. The cars are pushed through the furnace by a hydraulic ram, and travel at the rate of approximately 6 feet per hour. The ram does not extend through the furnace, but only pushes on the last car, and a loaded car is admitted every hour.

While improvements in the tunnel kiln furnace eventually resulted in reducing the annealing cycle to 59 hours, the technical staff of the Saginaw Malleable Iron Division continued to investigate various phases in the production of malleable cast iron from the viewpoint of obtaining a quality product in the shortest possible time. It was found that by careful control of various factors, such as chemical composition, raw materials, melting process, and molding and pouring conditions, it was possible to obtain a desirable product in a comparatively short period through close control of the several stages comprising the annealing cycle.

With that information available, the next step was to put it into practical application on a commercial scale, and that was accomplished in co-operation with the manufacturer of the equipment through use of the radiant heating tube furnace with controlled atmosphere. As a result of that work, malleable cast iron now is produced in a 30-hour cycle at the rate of 55 tons per day.

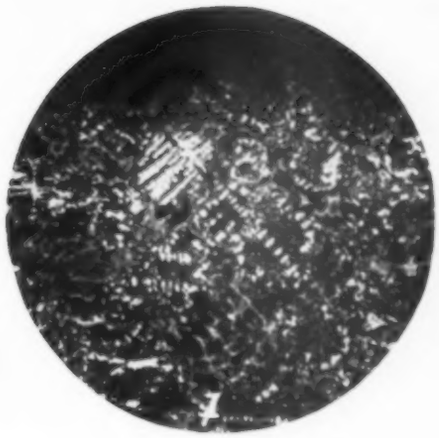
Furnace Dimensions Are Given

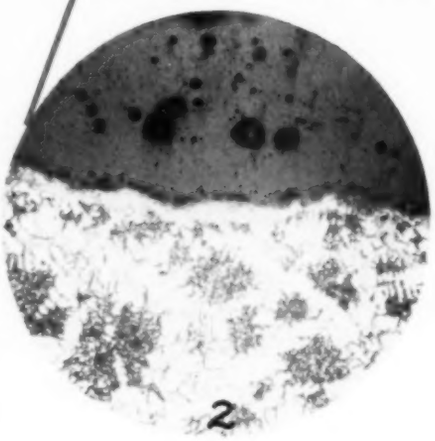
The furnace, which is shown in Fig. 15, has an outside width of 20 feet and a length of 115 feet. Each end of the furnace is provided with a vestibule with inner and outer doors, one of which always is closed to prevent infiltration of air. The inside dimensions of the furnace are about 15 feet wide, and 102 feet between the inner doors of the vestibules. The furnace is divided into 4 zones of accurately controlled temperature conditions of which first is the heating-up zone or bringing to maximum temperature. That zone is about 28 feet long. The second is the holding zone which is about 33 feet long, while the third is the rapid cooling zone which is about 6 feet long. The fourth and final zone is that for slow cooling, and is about 34½ feet long.

Heating of the furnace is accomplished through 48 heat resisting, alloy steel tubes which are 3 and 4 inches in inside diameter. Part of the tubes are located at the top and part at the bottom of the furnace, and are distributed as follows: In the heating-up zone there are 6 tubes above the work, and 6 tubes below; in the holding zone 6 tubes are above, and 7 tubes below; in the rapid cooling zone there are 3 tubes above and 9 tubes below while in the slow cooling zone all 11 (*Please turn to page* 92)

Fig. 17—In the trimming department all excess metal is removed on sprue cutting machines, and then the castings are ground at those points to give a smooth finish

Blistering Of Porcelain Enamel On Cast Iron





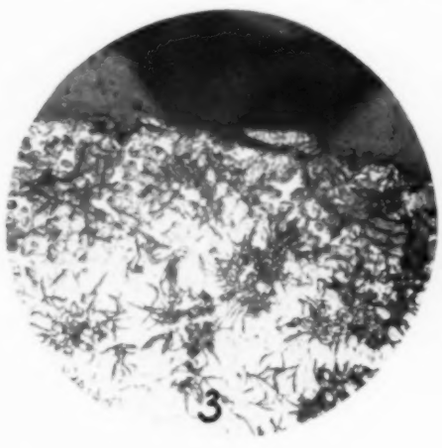
By E. E. HOWE and M. E. MANSON
Chicago Vitreous Enamel Products Co., Chicago

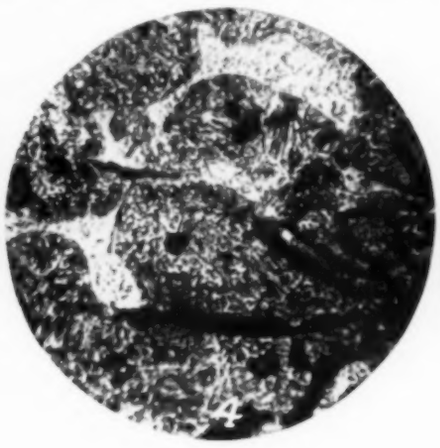
PROBLEM of blistering of porcelain enamel applied to cast iron is still of considerable importance, in spite of the large amount of work done on the subject by various investigators, especially Krynitsky and Harrison[1] and E. P. Poste[2]. One of the greatest difficulties in the investigation of the problem is the securing of samples of definitely blistering iron. It would seem that metallography could be of great help in the investigation of this phenomenon if only enough samples could be obtained for comparison of the structural characteristics with those of nonblistering irons. Based on the idea that the more photomicrographs of blistering iron that are published, the more chance there will be of eventually solving this problem, an example of blistering iron, which recently came to the attention of the authors is herein described.

This case is especially interesting because it illustrates probably the most important facts brought out by the investigators mentioned previously. As a result of their work, it is generally conceded today that blistering is caused by the breakdown of combined carbon during the enameling process forming carbon monoxide and carbon dioxide gas which is entrapped in the enamel in the form of large bubbles. The actual mechanics or chemistry of the process is still obscure, but a few things are known.

An iron containing all of its carbon in the form of graphite will not blister. An iron in which the combined carbon is so stable that no breakdown occurs at enameling temperatures, probably will not blister. An iron in which the combined carbon is so unstable that a nearly complete breakdown occurs before the enamel coat fuses, probably will not blister. But an iron in which the stability of the (*Please turn to page* 95)

Fig. 1 (Upper right)—Raw casting No. 1 which did not blister. Nitol etched, X 100. Fig. 2 (Upper left)—Casting No. 1 after enameling. Nitol etched, X 100. Fig. 3 (Lower left) Casting No. 2 which blistered. Nitol etched, X 100. Fig. 4 (Lower center)—Same as Fig. 3 near the enamel-iron interface. Nitol etched, X 850. Fig. 5 (Lower right)—Same as Fig. 3 near the center of the casting. Nitol etched, X 850





How Shall I Slag

By DON J. REESE
International Nickel Co., Bayonne, N. J.

COKE contains ash, and metals are contaminated with sand and rust. Therefore, melting metal in a cupola produces a certain amount of slag. Even if it were possible to get an ashless coke, and to clean the surface of all metal entering the cupola, we still would have abrasive and temperature reactions on the refractory lining, melting losses of silicon, manganese and iron. The metallic charge would contain some nonmetallic impurities. Melting metal invariably means the formation of slag. The cupola melting process is no exception.

This slag forming tendency of the melting operation is accepted as a matter of fact. Where the cupola is in blast for more than an hour or two, limestone or some other fluxing material is added, to change the composition of the slag from one that is difficult to remove and which easily might handicap the melting process, to one which is less difficult to remove, and which actually improves melting conditions. Many foundrymen operate a cupola only for an hour or two each day. They neither add fluxing material nor remove any slag during the progress of the heat. Others who flux their cupolas are concerned mainly with the disposal of the resulting nonsalable byproduct.

More Slag in Present Practice

Old time melters started adding flux on the third, fourth and fifth charge. Present day practice favors a good dose of flux on top of the bed coke and on every charge, regardless of whether the cupola is in operation for 1 hour or for 30 hours.

Air introduced into the cupola at the tuyere level travels upward and combines with the coke to generate heat. Temperature at the tuyeres is relatively cold, because air introduced at this point usually is at room temperature. With a preheating system the temperature may be 500 degrees Fahr. Under either condition the cold air combining with the fuel will produce a lower temperature than the combination of fuel with highly heated air. The maximum temperature zone in a cupola is at the top of the coke bed. The tuyere zone of the cupola is a cooling zone.

Slag accumulates in the well or reservoir of the cupola and prevents the cold air from the tuyeres from circulating through this zone. Air in this section would have a slight tendency to combine with the coke to generate heat, but it would have a far greater tendency to cool any metal accumulated in the well. Slag in this zone insulates metal from cooling air currents and increases the tapping temperature from 50 to 75 degrees. This improvement in temperature is most noticeable early in the heat, a period when cold iron is most likely to appear and where an increase of 50 degrees in temperature is most appreciated.

Even though the arguments sound logical, some foundrymen may be skeptical about the cooling effects of the tuyere zone and the cupola well on the metal temperature. To prove the point, where the cupola is tapped intermittently, it only is necessary to watch a few taps and take a few pyrometer readings of the stream. In many instances it will be found that the last metal is 150 degrees hotter than the first metal tapped.

Fluxed Metal Is Cleaner

Metal entering the melting zone of the cupola still is in the solid state. Temperature in this zone probably is close to 3100 degrees Fahr. In absorbing heat, the outside of the metal is much hotter than the center. The surface reaches melting temperature first. Surface metal melts, drops off the piece and trickles down in drops through the coke bed. These drops in contact with the ash of the coke become contaminated. While passing through a layer of slag, the slag acts as a filter. Impurities are held back and retained in the slag, while the filtered metal falls into the well. Contrary to a loosely held but somewhat general opinion, metal tapped from a cupola purposely fluxed will contain less entrained slag than metal from a cupola that is not fluxed.

In practically all metallurgical melting the quality of the product is related to the slag. Melters on open hearth and electric furnaces know that the metal will be of inferior quality unless the heat is worked under the proper slag. Little published data are available on this phase of cupola practice, but it seems reasonable to assume that what is true of other melting processes also may apply to the cupola.

Two general methods are in vogue for removing slag from the cupola. In one the slag flows through a hole

My Cupola ?

in the back, and in the other the slag flows through the tap hole in front.

Rear slagging may be intermittent or continuous depending on whether the tap hole is opened periodically or allowed to remain open. The second instance infers that a calibrated tap hole is provided and that some storage of metal is maintained in the cupola. This type of tapping is successful only where the area of the tap hole is correct for the melting rate of the cupola and the static pressure existing at the tap hole.

For example at 43/64-inch diameter tap hole is large enough to handle 11 tons of iron per hour at a given static pressure. If the head of metal in the well is increased, this size would be too large, while if the head of metal is decreased, the tap hole would be too small. The accompanying table shows the approximate diameter of the tap hole required for this type of operation. Analysis of the tap hole diameters will show that this type of operation is suited best to melting rates of 10 tons per hour or more.

With the proper size tap hole in operation, slag accumulates on the surface of the metal at an elevation close to the slag hole. Amount of slag accumulated in the well is less than with intermittent tapping. The slag is removed continuously, therefore the diameter of the slag hole is not as large as would be required for equivalent melting with intermittent tapping.

Maintain Fixed Diameter Opening

One prevalent slag hole problem is how to maintain for many hours an opening of fixed diameter. Another is how to maintain any slag hole at all. The first problem appears with continuous tapping and slagging. Unless the composition of the slag is relatively neutral in chemical reactions at temperatures of 2600 to 2900 degrees Fahr., a reaction takes place between the slag and the material surrounding the slag hole. The simplest corrective measure is to change the composition of the slag. Alternative methods include the substitution of denser refractory material, or material which reacts chemically in the same manner as the slag. The first method is preferable.

Not many years ago the cupola charge consisted of 50 to 60 per cent pig iron and the remainder cast iron scrap. Today the amount of pig iron in the charge is much less, while the use of steel scrap in amounts between 30 and 50 per cent is quite common. The term steel scrap includes practically everything between turnings and rails. Material shipped away from production shops a few years ago as waste material, now is salvaged for melting stock in the cupola. Trouble at the slag hole invariably will develop with the use of this material, unless the slag is adjusted to correspond.

Where steel is melted in the cupola, the resulting metal temperatures are higher than where gray iron is melted without any steel addition. Temperature of the slag also is higher. Since slag is more fluid and more reactive chemically at the higher temperatures, it is necessary to alter the composition to prevent lining and slag hole trouble. A more important factor is the increased amount of iron and manganese oxides produced. These oxides react as bases at high temperatures. Silica combines with them to form neutral slags. Unless silica is available in the cupola charge it will be taken from the lining in the melting zone and from around the slag hole. In many instances the slag hole problem may be solved by deliberately adding sand, burned cores, etc., to the cupola charge. The sand supplies the necessary amount of silica to neutralize the slag.

Intermittent slagging follows intermittent tapping. Damage to the slag hole usually is mechanical, caused by the bar employed in re- (*Please turn to page* 96)

QUESTIONS and ANSWERS

This department includes problems relating to metallurgical, melting and molding practice encountered in making castings. Questions from subscribers addressed to the Editor of The Foundry will be answered by members of the editorial staff, supplemented where occasion requires by the advisory staff.

Leakage in Cupola Blower May Result in Slow Melting

We are operating a cupola lined to 42 inches and melting 4½ tons of iron per hour. The blast is supplied by a positive displacement blower rotating at 155 revolutions per minute. The blower is a No. 5 with a 15-inch diameter outlet, the blast pipe going into the cupola being 14-inches in diameter. The tuyeres used are 8½ x 6½ inches at the shell and 17 x 6½ inches at the lining. We would like to melt 6½ tons of metal per hour, and would like to know what increase in blower speeds will be required. Also, we wonder if the tuyeres are too large; that we also are melting too close to the tuyeres although having such a low blast perhaps would melt too low, and the brick lining burns out rapidly.

According to available information, your blower when new had a capacity of 4500 cubic feet of air operated at 236 revolutions per minute, or 2955 cubic feet at your present speed of 155 revolutions per minute. Undoubtedly, however, your blower has had a long service and considerable wear has taken place so that it may deliver considerably less air than mentioned. Also, there may be considerable leakage in the blast pipe, windbox, etc. so that in the end you are only obtaining enough air to melt the 4½ tons per hour.

Based on the rough and ready figure of 30,000 cubic feet of air required to melt a ton of iron, your present melting rate of 4½ tons per hour will require 2250 cubic feet of air per minute. On the same basis the melting of 6½ tons per hour would require 3500 cubic feet of air per minute. On the basis of the figures previously given that the blower supplies 4500 cubic feet of air at 236 revolutions per minute when new, it should supply 3500 cubic feet of air per minute at 183 revolutions per minute. However, if wear and leakage are very bad, still higher speeds would have to be employed, and the only method of obtaining a correct knowledge would be to employ some type of volume meter in the blast line at the cupola.

You did not state how many tuyeres you had in your cupola so it is difficult to determine whether you might get better results by changing their dimensions. If you have six tuyeres the total area is 331½ square inches, based on the opening into the shell which is the proper one to use, or a ratio of tuyere area to cupola area of 1 to 4. If you have only four tuyeres the area will be 221 square inches or a ratio of 1 to 6.3. While there are no definite standards set up on the relation of tuyere area to cupola area, in general a cupola of 42 inches in diameter has a ratio of 1 to 6 or 7. Consequently, if you have only four tuyeres the ratio is about right, but if you have six tuyeres the ratio is too high. You might try blocking up the tuyeres by putting in a layer of 2-inch brick along the bottom and see what effect is obtained. Use of the layer of 2-inch brick would give you a tuyeres dimension of 8½ x 4½ or a total area of 229½ square inches or a ratio of approximately 1 to 6.

You do not mention anything about the size of the charges you use, but in a cupola of that size, we believe that the charges of iron should not be over 1500 pounds, and preferably 1000 pounds each. Also, it is possible that the coke you are now using is rather weak in structure and tends to break easily, so that the charges when placed on it in the cupola break it up and increase radically the resistance to air passing up through the cupola. A strong firm coke will support the burden of the charges without breaking, and thus aids in better combustion as that permits the air to pass through easier.

Aluminum Castings Have Wavy Surfaces on Flat Portions

We are experiencing trouble in making aluminum castings by appearance of waves on the flat surface of both cope and drag side with few exceptions. The same results are obtained with either hot or cooled metal.

Without having a section of the casting containing the defect mentioned for examination, it is difficult

to supply a definite answer. The first thought that comes to mind is that the waves are cold shuts. That condition may result from not having the metal at a sufficiently high temperature, or from not keeping the sprue full of metal until the casting cavity is filled completely. You mentioned however, that it occurs whether the metal is hot or cooled, and that apparently eliminates one of the causes mentioned previously. However, it is possible that your hot metal is not quite hot enough to pour the castings properly and we suggest that you try increasing the temperature.

If the cold shuts arise from improper pouring, that is to say, the sprues are not kept filled, it will be necessary to watch that operation carefully to see that instructions relating to pouring are carried out. It is absolutely necessary that the metal be poured fast enough to keep the sprue filled, and that condition maintained throughout until the casting cavity is filled or trouble will occur Men pouring the metal sometimes have a tendency to slack off pouring slightly, sufficiently so that the metal in the sprue drops down considerably, and that forms a discontinuity of surface. Another possible reason may be that the gates are not sufficiently choked to make it possible for the sprues to be kept full, and it is suggested that you look into that phase.

Small Core Burns Onto Inside Of Heavy Casting

We have a small curved core about ¾-inch diameter in a 250-pound gray iron casting. The iron mixture contains 70 per cent steel and must be poured at a high temperature. The metal seems to burn the core and freezes the core wires in place. Do you know of any special sand mixture or other preparation for cores to withstand metal showing a temperature of approximately 2800 degrees at the spout.

In steel foundry practice where the metal is melted and poured at a higher temperature than you experience, the cores which are subjected to the pressure and high temperature of large bodies of metal, are made from silica sand in which a certain amount of silica flour is incorporated. The bonding element is held to a minimum, the cores are dried almost to the burning point and large vent passages are provided.

Tendency of cast iron containing large amounts of steel to apparently soak into a core always has been a troublesome problem for which there is no hard and fast remedy. Method adopted in any given instance depends to a considerable extent on local conditions, shape and size of the core, position in the mold and volume of metal.

In many instances the simplest solution of the problem is to use a piece of steel pipe instead of a dry sand core. Where there is danger of the pipe collapsing through heat and pressure, it may be filled with dried sand, silica flour or plumbago. The outside of the pipe must be cleaned, preferably by sandblasting, to prevent the metal from boiling away from it and forming blow holes in the casting. In certain instances a good coating of silica wash on a silica sand core is sufficient. In other instances the problem has been solved by winding the core with wire. As with the steel pipe, the wire must be clean.

Providing a Nonskid Surface On Iron Gangway Plates

We are going to make some cast iron blocks for the foundry gangway. To provide a nonskid surface we propose to face the blocks with aluminum oxide. Can you tell us how to do this so that we may have a flat surface with the abrasive grains bedded in the iron.

As we have pointed out on former occasions when this subject came up for discussion, the method employed for applying an abrasive coating to castings is a proprietary process covered by patent. The surface to be treated is moistened usually with sodium silicate. The abrasive material is sifted over the surface in the same manner that porcelain enamel powder is sifted over sanitary ware castings. The pattern then is *stamped* back. In some instances molasses water or a thin clay wash is substituted for the sodium silicate. In all instances the part of the mold thus treated is skin dried.

The pattern is molded with the finished face in the drag, and exceedingly hot iron is required to secure a satisfactory union of the abrasive with the metal. Familiarity with many of the lesser details, only to be gained through actual experience, is required on the part of any person engaged in the production of castings of this type. For your present purpose, gangway blocks or plates we suggest the use of ordinary castings with criss-cross corrugations on the face. Incidentally we might direct your attention to interesting types of reinforced road construction described and illustrated in the Nov. 15, 1935 issue of THE FOUNDRY.

Linings in Furnaces and Ladles Must Be Dried Carefully

We are having trouble with newly lined furnaces, hand and bull ladles used in our brass foundry. The furnace is the indirect arc electric type, and the ladles range in capacity from 50 to 125 pounds. These are used for our regular brass mixtures such as 85 per cent copper, 9 per cent tin, 2 per cent lead, 4 per cent zinc, and 0.25 per cent phosphorus. With the furnace the first heat usually is composed of chips and borings which are made into ingots, and the second employs one of our regular compositions. However, the metal from that heat seems to cut into the sand and cores as the castings are a mass of fins. However, after the fins are removed, the castings are sound. The same thing occurs with the ladles, but usually we pour the metal back into the furnace before starting to pour.

From your description, your trouble evidently results from not having the linings in both ladles and furnace thoroughly dried. In the case of the furnace, it is suggested that as soon as the lining is placed in position that you try it out gradually to prevent cracking. The procedure, of course, is to start wth a small wood fire and gradually increase it until you have one that is good and hot. Also, you should keep the fire in for a long period of time, so that the lining is dried thoroughly throughout. The same should apply in the cases of the ladles, but since they can be handled easily, it is advisable to build some kind of furnace or heating rack to do the drying. Linings that are not thoroughly dried cause the metal to boil and become full of oxides.

Wants Good Surface On Lamp Castings

We are making hexagonal lamp standard castings 11 feet in length, but the surface is so rough we have to grind them all over before they are acceptable. We shall appreciate your advice on how to produce smooth castings.

From the description, we are at a loss to determine whether by a rough surface you mean a clean but uneven surface, or, a dirty surface, that is a surface to which the sand adheres. In the first instance the sand is too coarse. The grains do not lie together closely enough and the iron presses into the spaces between. The obvious remedy is to use a finer sand for facing the pattern. In the second instance the sand is not sufficiently refractory and contains too much clay. The heat of the iron fuses the clay to form a slag which adheres to the surface of the casting.

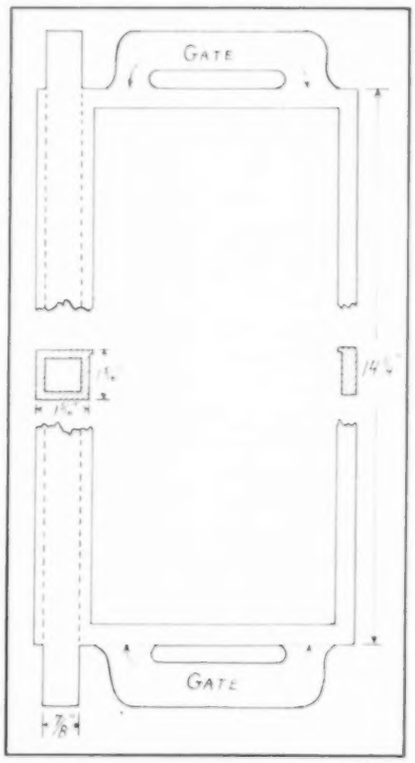
If the addition of coal dust in the proportion of 1 part coal dust to 8 parts sand to the facing does not produce a clean smooth surface on the castings, the sand is not suitable and should be replaced by a more refractory grade. In certain instances where the sand is on the border line, a smooth surface may be produced on the casting by brushing the surface of the mold with plumbago. If, by a rough surface you are referring to swells, blisters, scabs, or excessive fins, that is something else, involving both material and workmanship.

Enclose Brass Tube In Aluminum

We are enclosing a cross sectional part of an aluminum casting, also a sketch showing the entire casting and the method of gating. We have been using a sand core, but our customer now proposes to use a square brass tube insead of the core to provide a smooth straight hole and thus eliminate machining. We have tried different methods of gating, have smoked the tube and heated it, but the castings show blow holes on the cope side and occasionally on the drag side of the casting after machining. Can you suggest any method or treatment by which we can secure clean, solid castings.

The sketch shows a uniform thickness of metal in that part of the casting surrounding the tube or core. In the cross sectional piece submitted the thickness of metal is much greater on the drag and on one side, than it is on the cope or the other side. This would seem to indicate that the core either was not perfectly straight in the first place, or, that it sprung in the center from metal pressure. The possibility exists that the customer's objection is based on the fact that this opening is not perfectly straight.

If that is the case you can continue using the sand core, but you must see that it is perfectly straight and that it remains straight while the mold is filling with metal. This may be done either by reinforcing the core with a length of perforated ½-inch steel pipe, or by the use of small chaplets. We do not think the use of a brass tube is feasible, if for no other reason than that it will not be gripped firmly in the casting and therefore eventually will work loose.



Unless held by chaplets the tube or core will spring in the center

Of course this feature may be overcome to a certain extent by notching the tube or forming other suitable anchorage for the aluminum. However, the principal objection is that despite practically any precaution, a certain amount of gas is formed when the molten metal comes into contact with the tube. Aluminum sets so quickly, especially in this thin section, that the gas is trapped to form the blow holes to which you refer. Experimentally you might try one or two. The tube must be absolutely clean, either by sandblasting or by rubbing with sandpaper or emery cloth. It then is coated lightly with gasoline or kerosine oil. Gate the casting so that the metal runs over the tube.

Shrinkage Occurs in Propeller Hub

We are having trouble with shrinkage in the hub of a 3-bladed 52-inch bronze propeller. This hub is approximately 9-inches in diameter and 14-inches long with a 3-inch core. We use two straight, round risers as large as space permits and pour from the top, through a smaller sprue. We have tried churning some of the hubs, but they are as bad as the ones not churned. Do you think churning bronze or brass is advisable? We use scrap bronze and copper and since we have no analysis of our scrap our zinc and tin additions are purely guesswork. We melt our metal in the cupola. How can we keep the hub from shrinking?

We assume that you are speaking of casting the propeller wheels from manganese bronze, although this is not so stated. If we are correct in this assumption we would advise as follows: The value of churning risers of manganese bronze castings is in keeping the opening from the riser to the casting free to permit the steady flow of liquid metal from the riser to the casting and thus insure sound casting. If it is possible to insure the maintenance of a clear, uninterrupted opening that does not freeze without churning, then churning is of little value provided the riser is of sufficient height to insure pressure enough to force the metal to flow.

If the trouble occurs in every casting you make of that size, it indicates that your feeding is inadequate. If the difficulty occurs only occasionally, it may be due to the fact that your risers are not kept hot enough to insure fluid metal therein. A good practice in castings where feeding is difficult is to have a pot of metal available that has been heated hotter than usual and pour this into the riser some time after the casting has begun to set. In large castings we have known of cases where additional hot metal was added to the riser 2 or 3 hours after the castings had been poured. In your case, 15 or 20 minutes after pouring the castings, hot metal could be added to the risers thus increasing their fluidity and providing the necessary fluid metal to feed the shrinking hub which now gives you trouble.

Increasing the height of your risers and pouring in the superheated metal as the risers begin to cool off, we believe will correct your difficulty. Adding hot metal two or three times after the castings have been poured frequently produces the necessary fluid metal to take care of the shrinkage. The only additional precaution is to insure an opportunity for this fluid metal to reach the casting.

Adds Aluminum to Yellow Brass

We are making some castings of a yellow brass containing 3 pounds of lead per 100 pounds of metal, and are having some difficulty in obtaining satisfactory castings. We understand that aluminum will help in overcoming some of our trouble, and would like to know what its effect is.

Aluminum has been added successfully to yellow brasses containing up to 5 per cent lead, and its function is to aid in castability. The quantity generally is 2 or 3 ounces per 100 pounds of metal. Brasses high in zinc usually are difficult to cast, and the addition of aluminum improves the fluidity or flowability. The aluminum also forms an oxide skin which in the molten state, prevents the escape of zinc fumes, provided the temperature does not get too high.

However, where aluminum is employed, the yellow brasses cannot be used for pressure work as they generally leak due to inclusions resulting from parts of the aluminum oxide skin being carried into the mold cavity. Possibly by careful gate design, the castings might be solid and free from porosity. The essential point is to get the molten metal into the cavity without disturbing the aluminum oxide skin or film — and that is accomplished successfully with aluminum bronze and manganese bronze which as you know contain appreciable quantities of aluminum.

Presents Data On Pot Coatings

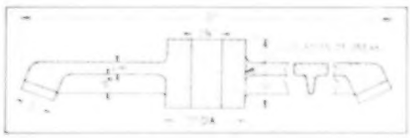
Some time ago we read in one of the issues of THE FOUNDRY that thin solutions of whiting or lime are used for coating cast iron pots employed in melting aluminum. However, we cannot recall the reference, but would like to find out the composition of such coatings.

As you well can realize, many foundries have developed *pet* solutions for coating aluminum melting pot interiors. However, there is nothing very complicated in making a suitable solution. It may or may not contain waterglass (sodium silicate), but usually that material is employed because waterglass holds the other ingredients in suspension much better.

One recommended mixture is composed of 12 pounds of whiting, 1 pound of plumbago, 6 gallons of water and ½-pint of waterglass. Another is comprised of 1 part of lime and 1 part of water, both by volume. From those you can make variations to obtain what you believe to be the most suitable solution. In any case do not use thick coatings as they tend to flake off, exposing the metal of the pot to action of the molten aluminum.

Gate Causes Cracks In Gear Arms

We are enclosing sketch of a 31-inch diameter bevel gear in which one or two of the arms crack at the hub several days after the casting has been cleaned. The wheel is gated between the arms and fed through two large risers on the hub. The metal is a semisteel mixture containing nickel and molybdenum showing the following



Cross section of cast iron bevel gear in which arms crack at hub

analysis: Carbon, 3.20 per cent; silicon, 1.64 per cent; nickel, 1.20 per cent, and molybdenum, 0.40 per cent.

Cross section of the gear shown in your sketch is of normal and satisfactory design. Therefore some factor other than ordinary contraction must be responsible for the cracked arms. Since you do not furnish any details of molding practice we can only suggest the two most probable causes of the trouble. Presumably the mold is green sand and made in a wood flask. Unless the cope is provided with a strongback, or with a piece of rail or other suitable reinforcement, it will spring from the pressure of the iron and result in a fin between the arms.

Naturally this thin fin will cool first and prevent normal contraction. Even if the casting does not crack in the mold, a strain is present and will produce a rupture sooner or later. In the second probable cause, the mold is made either in a properly braced wood flask, or in an iron flask, which prevents the formation of a fin between the arms. However, the sprue is located too close to a bar. The lower end of the sprue terminates in gates attached to the arms. The result is that the rigidly held sprue prevents the arms from contracting in a normal manner.

Incidentally it is interesting to note that a wood cope strong enough to resist ordinary pressure on the mold, will yield to the additional pressure exerted through a feeding rod and two large risers on the hub. This is a feature frequently overlooked. A molder will force iron into a feeder under the impression that the casting is shrinking, when in reality he is increasing the bulk of the casting through forcing the walls apart. For a number of reasons, which it is not necessary to enumerate at the moment, the gate between the arms is not as satisfactory as a pop gate on top of the hub. With a 1-inch pop gate on the hub, a 3-inch diameter riser and a firm mold you should have no further trouble.

Drying Temperature May Be Too Low

I have some peculiar shaped boiler castings to make for a hot water installation in which the outer part of the casting is a water jacket. The core for the water jacket is shore sand bonded with oil, but I have difficulty in venting the core. Certain parts of the core are formed with strickles and the vent rods interfere with their application. I have tried wax vents, but the sand does not seem to absorb the wax. The core is quite soft in the vicinity. Straw is not satisfactory and cinders make a mess. The core is from 1½ to 2 inches thick with a total area of about 9 square feet and is totally enclosed except for the vent openings which afterward are plugged. I shall appreciate your advice on how these cores are made in American foundries.

In the absence of a sketch or drawing we are at a loss to determine whether the core is an upright ring or a flat disk. Naturally the shape of the core will dictate to a considerable extent the best method for venting it. Generally speaking practice in American foundries is the same as it is elsewhere. Clean sharp sand is bonded with oil in the approximate proportion of 1 part oil to 50 parts sand. Rods are employed to form the vent passages. In exceptionally difficult places wax vents are introduced.

The vent rods are introduced through suitable small holes in the corebox and after the core is finished the rods are pulled out. In this way they will not interfere with the use of the strickles. After the vent rods are removed and after the corebox has been removed from the core, all the holes with the exception of those in the prints are plugged either in the green state or after the core is dried. Without actual experience we should not like to venture an opinion on the quality of the vent wax in use. However, since presumably it is used as extensively over there as it is in this country, the material must have merit. You may not be drying the cores at a sufficiently high temperature to thoroughly evaporate all the wax.

R. B. Crawford

G. W. Merrefield

John Howe Hall

P. R. Schilling

MEN of INDUSTRY

ROBERT BLAIR CRAWFORD, recently elected chairman of the Detroit Chapter of the American Foundrymen's association, is vice president and treasurer, Atlas Foundry Co., Detroit. Mr. Crawford was born Aug. 3, 1901 in Glasgow, Scotland. He graduated from Western High school, Detroit, and entered the University of Michigan where he received his degree of bachelor of science in chemical engineering in 1923. He then became associated with his father, the late Robert Crawford, in the Atlas Foundry Co., and has been connected with the company since that time. Mr. Crawford has been active in the organization and work of the Detroit chapter.

• • •

GLENN W. MERREFIELD, formerly general foundry superintendent, has been made plant manager of the Alhambra, Calif., plant of the Kay-Brunner Steel Products Inc., Los Angeles. Mr. Merrefield received his foundry training as a special apprentice at the Indiana Harbor Works of the American Steel Foundries, and has been connected with the foundry industry for over 20 years. During that time he was general manager of the West Michigan Steel Foundry, Muskegon, Mich., and manager of the foundry department of the Clark Equipment Co., Buchanan, Mich., Pettibone-Mulliken Co., Chicago, and the Lorain Steel Co., Johnstown, Pa. He was made general foundry superintendent of the Alhambra plant in the summer of 1935.

• • •

JOHN HOWE HALL, technical assistant to the president, Taylor-Wharton Iron & Steel Co., High Bridge, N. J., has resigned to establish his own consulting metallurgical practice with headquarters for the present at High Bridge. Mr. Hall was educated at Harvard, receiving his bachelors degree in 1903 and his masters degree in 1904. The next year was spent under the direction of Prof. Sauveur doing research work in the manufacture and properties of vanadium steel. From 1904 to 1906 he was employed by the Bethlehem Steel Co. where he worked in open hearth, puddle mill, steel foundry, metallurgical laboratory and crucible steel departments. In the summer of 1906 he worked as a crucible steel melter in a small steel foundry in Buffalo. Late that year he entered the laboratory of the Taylor-Wharton Iron & Steel Co. and has been connected with that organization since, with the exception of 1913 and 14 when he engaged in the practice of consulting metallurgist in New York. With the Taylor-Wharton company, he has at various times been in charge of the laboratory, heat treating and steel making departments. He has worked on new metals and products, the development of new processes, design of new equipment, and the organization of manufacture by new methods.

He was the first to use the so-called intermediate manganese steel in castings, and introduced the practice of quenching and reheating alloy steel castings. Mr. Hall has written many papers for various technical societies and the technical press, and is on the editorial advisory staff of THE FOUNDRY. He is a co-author of the *A. B. C. of Iron and Steel*, and the author of *The Steel Foundry*. He is a member of the British Iron & Steel institute, Electrochemical society, American Society for Testing Materials, American Society for Metals, American Institute of Mining and Metallurgical Engineers, and an honorary member of the American Foundrymen's association. He was the first recipient of the J. H. Whiting medal of the A. F. A. award for outstanding achievements in metallurgy in the iron and steel industry. Recently Mr. Hall was made chairman of the steel division of the A. F. A.

• • •

P. R. SCHILLING recently has returned to the Superior Steel & Malleable Castings Co., Benton Harbor, Mich., as assistant to the president. Mr. Schilling was graduated from Rensselaer Polytechnic institute, Troy, N. Y., in 1921 with a degree in electrical engineering. Following graduation he became associated with the United Traction Co. Mr.

(*Continued on page* 44)

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(*Continued from page* 42)
Schilling had spent his vacations working for the Troy Malleable Iron Works, Troy, N. Y., and in 1922 he became interested in that line of endeavor, joining the American Malleable Castings association, now the Malleable Iron Research institute, as inspector. He left that position to become assistant to the general manager, Superior Steel & Malleable Castings Co. Later he was appointed superintendent of the malleable foundry of that company. In November, 1928, he accepted a position as superintendent of the Wagner Malleable Iron Co., Decatur, Ill., and placed in operation the Kalamazoo Iron Foundry, Kalamazoo, Mich., which had been acquired by that company. He resigned that position to take charge of the malleable iron foundry of Pratt & Letchworth Co., Buffalo. In 1930 he was appointed assistant superintendent, malleable iron foundry of the General Electric Co., Erie, Pa. Shortly after his association with that company, he became assistant superintendent of the three foundries and patternshop at Erie. Six years later he was taken from the foundry division to become supervisor of conferences, or head of the Erie works new management development program. Later he was recalled to the foundry when business expanded. Also, for the past 4 years he has been an instructor in the night school of the Erie works of the General Electric Co., in metallurgy and foundry practice.

♦ ♦ ♦

WILLIAM C. CARTER, formerly general superintendent, Link-Belt Co., Chicago, has been elected a vice president. Mr. Carter, a mechanical engineering graduate of the University of Illinois, joined the Link-Belt organization in 1902 as a draftsman. He has served consecutively in the positions of engineering department supervisor, construction superintendent, plant superintendent, plant general manager, and in recent years has been in charge of company production.

EDWARD J. BURNELL, formerly general plant manager, Link-Belt Co., Chicago, also has been elected a vice president. Mr. Burnell studied mechanical engineering at Lehigh university and joined the organization in 1913 as a draftsman. He has consecutively held the positions of salesman, district manager at Boston, district sales manager at Pittsburgh, general sales manager of western division territory with headquarters at the Pershing road, Chicago plant, and more recently the position as general manager.

♦ ♦ ♦

W. E. PABST, who has served in various supervisory capacities for the Delco-Remy division, General Motors Corp., Anderson, Ind. for the past 25 years, has been made superintendent of the company's foundry at Anderson. Mr. Pabst succeeds B. A. DOLLENS, who has become superintendent of the relay and regulator plant.

F. W. CARL, for the past 8 years chemist and metallurgist, Delco-Remy division, has been made assistant superintendent of the foundry at Anderson.

♦ ♦ ♦

C. E. ATTWOOD has been elected president and a member of the board of directors of the Attwood Brass Works Inc. Grand Rapids, Mich. C. H. ATTWOOD has become vice president and director, and B. H. COOK, secretary, treasurer and a member of the board.

♦ ♦ ♦

HARRY W. DIETERT, Harry W. Dietert Co., Detroit, recently returned from a western trip where he addressed members of the Southern California Chapter, Los Angeles; the Northern California chapter, San Francisco; and the foundrymen of Seattle, consisting of the Washington section of the Gray Iron Founders' society and the Puget Sound chapter of the American Society for Metals. The latter talk was sponsored by the mechanical engineering department of the University of Washington.

♦ ♦ ♦

EDWARD MAY, recently retired after 28 years of service with the Buckeye Mfg. & Foundry Co., Overpeck, O., and was honored by a dinner given by his associates. Louis Bartel, foundry foreman, presented Mr. May with a lounging chair from the company. Short talks were given by Oscar Eberhardt, president and treasurer, and Paul Hurm, assistant treasurer.

♦ ♦ ♦

ALEXANDER W. LIMONT JR. has been appointed manager of the compressor division, Sullivan Machinery Co., Michigan City, Ind. Mr. Limont previously was connected with the E. I. duPont de Nemours & Co. Inc., Wilmington, Del., the Norwalk Iron Works, Norwalk, Conn., and the Ingersoll-Rand Co.

♦ ♦ ♦

DR. FRANK J. TONE, president, Carborundum Co., Niagara Falls, N. Y., has been elected to receive the Perkin medal of the Society of Chemical Industry for 1938. The medal is awarded annually for valuable work in applied chemistry and will be presented this year for his work in the development of abrasives and refractories.

♦ ♦ ♦

R. C. MOSS, recently manager of the Newark, N. J. plant, American Steel Foundries, has been transferred to the company's Verona plant near Pittsburgh, as sales manager in that district. He succeeds J. L. Cawthon who resigned.

HAROLD WALLIS, formerly associated with the American Steel Foundries, and more recently identified with the Smith Steel Casting Co., Milwaukee, has been made manager of the Newark plant of the American Steel Foundries.

Wm. C. Carter

Edward J. Burnell

W. E. Pabst

Fred Carl

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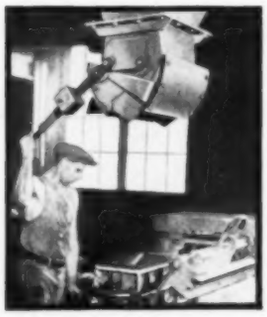

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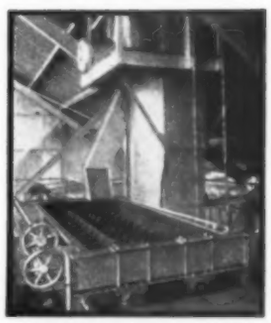

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St. Louis Chapter Holds First Conference at Rolla, Mo.

THE first regional foundry conference, held Oct. 8 and 9 at the Missouri School of Mines and Metallurgy, Rolla, Mo., by the St. Louis chapter of the American Foundrymen's association in co-operation with the school and the A. F. A., was exceptionally successful from the standpoint of both program and attendance.

An excellent program of practical and technical papers was arranged by the St. Louis chapter committee headed by L. J. Desparois, Pickands, Mather & Co., St. Louis, as general chairman and John W. Kelin, Federated Metals division, American Smelting & Refining Co., St. Louis, as secretary. G. S. Haley, Century Foundry, St. Louis, is chairman of the St. Louis chapter. Registered attendance was approximately 175. In addition, about 100 students at the school attended the various sessions.

Four papers were presented at the refractories session on Friday morning under the chairmanship of George W. Mitsch, American Car & Foundry Co., St. Louis. The first paper, "Linings for Reservoirs and Ladles Suitable for Soda Ash Treatment" by J. J. Offutt, A. P. Green Fire Brick Co., Mexico, Mo., was confined entirely to a discussion of mixing ladles. The speaker outlined a series of tests conducted on a 60 per cent alumina brick, a first quality stiff mud brick, and a special fired refractory. The alumina brick showed no signs of shrinkage or vitrification but in some instances, due to the high porosity of the refractory material, the slag penetrated entirely through the brick. The stiff mud brick developed some signs of vitrification. The slag did not penetrate to a very great depth, but rather the refractory seemed to be eroded and absorbed by the slag. This indicated that the temperatures had been high enough to soften the brick and lower the resistance to slag attack.

The special refractory developed no signs of overfiring or vitrification, and the erosion was noticeably less. However, on a 5-hour run the slag cup had been cut in at the base about ¼ to 3/16-inch. The best results in laying the bricks were secured with a dry fire clay base mortar which contained no sodium silicate and therefore was not air setting. A number of examples were presented to show the results secured with this refractory in practical applications.

L. C. Hewitt, Laclede-Christy Clay

Products Co., St. Louis, presented a paper on "Refractory Bonds and Grouting Material", in which he outlined the various materials used for that purpose.

The speaker stated that in general practice in lining and coating ladles in the average ferrous foundry, fire clay of the same type as is used in the manufacture of lining material itself, either alone or with the addition of some fine ground silica sand or fire clay grog, is employed. In holding ladles such as a bull ladle, experience indicates it is better practice to use one of the special-temperature cements. The speaker pointed out that special cements also are used in cementing stopper rods, particularly if the ladles are large and the metal is in the ladle for a considerable length of time.

Water Held to Minimum Amount

Mr. Hewitt stated that in using a refractory mortar or plastic material, reasonable care is necessary in the preparation of the particular material, including mixing, soaking, etc. Water content should be kept at a minimum necessary for the particular application. The higher the water content, the longer the period required for drying out. Also, sufficient time for drying should be allowed before high temperatures are applied. Steam rapidly forming in the plastic lining will cause the material to loosen or fall.

A paper "Refractories for Miscellaneous Foundry Furnaces" by George D. Cobaugh, Harbison-Walker Refractories Co., St. Louis, included a discussion of refractory materials for annealing ovens, core ovens, heat treating furnaces, car wheel annealing pits, rotary and air furnaces, electric furnaces, and nonferrous melting furnaces. The speaker also referred to the attention which now is paid to heat conservation through diminishing heat losses and increasing the amount of heat transferred to the charge.

He stated that insulating materials most frequently used on the outside of furnace walls are diatomaceous earth types of brick, both natural and calcined; compositions containing asbestos together with diatomaceous earth; expanded mica; monohydrated bauxite; rock wool; slag wool; granulated slag; and granulated crushed fire brick. According to the speaker, calcined diatomaceous earth brick are available for temperatures up to 2000 degrees Fahr. It was mentioned that the limiting factors for insulating refractories, when used directly exposed to furnace conditions, are inability to withstand abrasion, erosion, or corrosive slag action due to open, porous texture. Therefore, use necessarily is confined to parts not directly exposed to the action of coal ash, slags, etc.

In the final paper of the session, C. W. Berry, Walsh Refractories Corp., St. Louis, spoke on "Cupola Linings". The speaker discussed the various zones in the cupola and pointed to the conditions which must be encountered by the refractories. Above the charging door conditions are not severe and a good grade of brick will give satisfactory results and long life. Between the charging door and the top of the melting zone, temperatures are not exceptionally high and the slag action is not severe if a flux is added properly. However, that section is subjected to severe abrasion if the material is charged carelessly. In the top of the melting zone, higher temperatures are experienced in addition to abrasion of the moving charge. Also slag and molten iron are blown against the lining. In the melting zone the lining is subjected to high temperatures and for that reason must be highly refractory.

Failure Starts at the Joints

Slag action is most violent and the linings must be dense and well laid with as few and as narrow joints as possible, according to Mr. Berry. Failure starts at these joints and it is important to use a high grade of fire clay in laying the blocks. The nature of the charge has considerable bearing on the life of the cupola. A high percentage of steel scrap, with its higher melting temperature, decreases the life of the brick in the melting zone, according to the speaker. Steel scrap should be used in small pieces so that it will not divert the blast against the lining. It was recommended that fluxing materials should be kept at least 6 inches away from the lining. Also, the speaker stated that excessive blast is one of the causes of greatest trouble with brick linings in the cupola.

A simultaneous session on foundry sands was in charge of T. C. Hamlin, U. S. Radiator Corp., Edwardsville, Ill. Harry W. Dietert, Harry W. Dietert Co., Detroit, in a paper on "Sand Control Program in the Foundry", stressed particularly the composition of molding sand; the factors, including permeability, fineness, green strength, dry strength, deformation, and moisture which must be taken into consideration in proper sand control; mold control; and considerations in choosing a new sand. The speaker considered carefully the defects which may result through improper sand. These include defects caused by sand grains, clay bond, moisture, mold hardness, and flask equipment.

In the latter instance Mr. Dietert pointed out that the venting of a mold may be handicapped greatly by using flasks not vented on the side, or by using solid top and bottom boards. The depth of a flask also has its influence on mold hardness. A shallow squeeze flask will cause high mold hardness on raised pattern portions of the mold. On a jolt ram flask, the raised pattern portion in the shallow flask is low in mold hardness. Method of ramming, flask equipment, pattern equipment and mold hardness should receive more careful study.

Lester B. Knight Jr., National Engineering Co., Chicago, discussed the preparation of sand in a paper "Sand Reclamation, Sand Conditioning and Sand Control". Mr. Knight illustrated the application of sand preparing equipment both for jobbing and production foundries. He stressed the desirability of the control and removal of fines as an aid to controlling permeability. He pointed out that tests show the removal of from 2 to 3 per cent of fines from a given sand will result in a remarkable increase in permeability.

Mr. Knight concluded the discussion with the statement that successful sand control, conditioning and reclamation may be had by intelligent use of equipment to clean and screen the sand properly, controlling the amount of fines, mulling the sand correctly and aerating the sand after conditioning. The speaker also illustrated the savings possible through proper sand control.

Sand Causes Many Defects

A practical discussion of sand problems was presented by C. F. Bunting, Southern Malleable Iron Co., East St. Louis, Ill., in a paper "Relation Between Molding Sands and Casting Defects". In stressing the need for moisture control, Mr. Bunting pointed out that a wet sand is likely to produce a rough finish, due to the sand grains sticking to the pattern. While a slight excess of moisture is advantageous in increasing flowability and decreasing the sand-burn on the casting, these can be controlled better by using a more refractory sand or by the addition of sea coal. Sand with excess water is likely to produce blow holes. Therefore, it is of greatest importance to test for moisture and reduce it to a point where the best results can be obtained. Foundrymen should remember, in making the test, that sand will lose a slight amount of moisture if some time elapses between preparation and use.

Mr. Bunting also discussed green and dry permeability. He pointed out that in general if a smooth finish is desirable, the permeability must be kept low, at least below 30, while for castings where finish is

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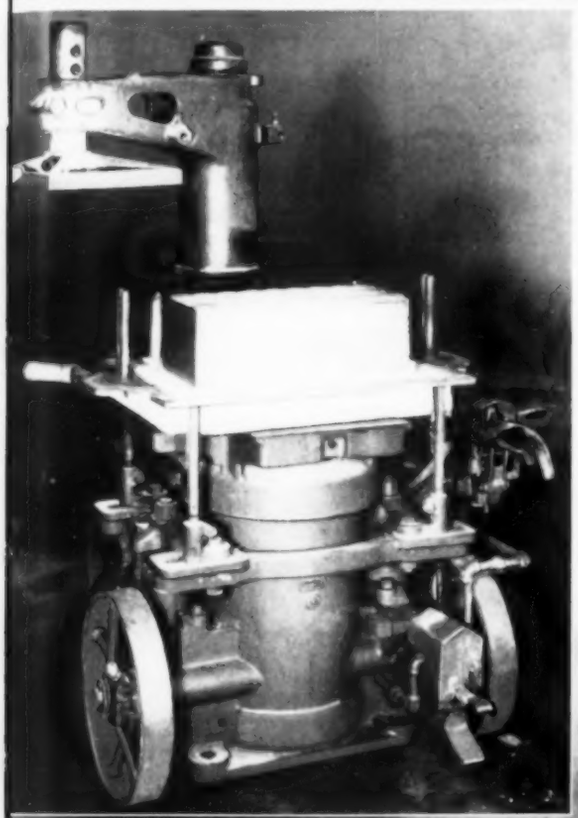
OSBORN
MOULDING MACHINES



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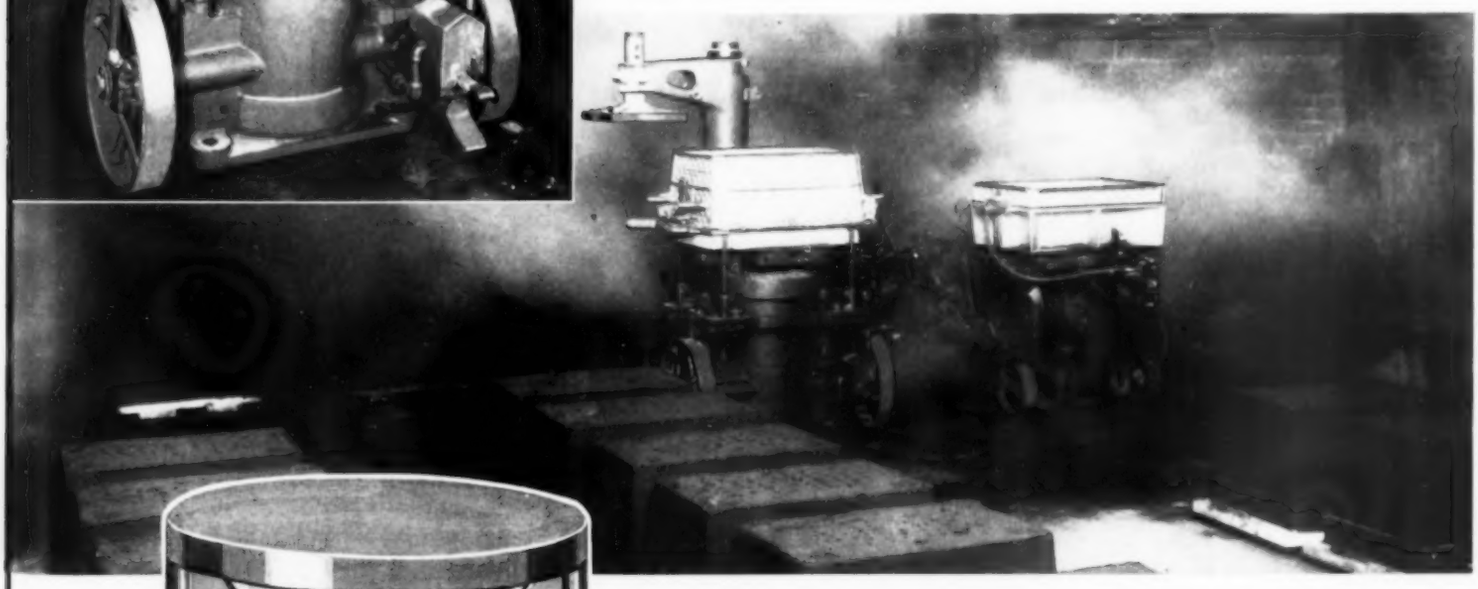

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(*Continued from page* 48)

not so important, it is better to run a little higher with due respect to moisture and strength. A permeability of 40 generally will give satisfactory finish, while at about 60 the finish may be on the rough side. Mold hardness or amount of ramming also has its affect on finish. The speaker stated that probably no other property of sand varies so much from shop to shop and even from floor to floor in the same foundry as mold hardness.

He also stated that sea coal added to sand is one of the most effective means of improving the finish. Sea coal affects all the properties of molding sand, tends to reduce the permeability, particularly when added in excess, reduces the contraction and expansion and requires more moisture to bring the sand to the same temper. When the metal is poured, the sea coal burns and deposits a film of carbon on the mold surface, thus producing less sandburn on the castings.

A luncheon on Friday noon was presided over by G. S. Haley, Century Foundry, St. Louis, and chairman of the St. Louis chapter of the A. F. A. William R. Chedsey, who recently became director of the Missouri School of Mines, welcomed the visitors to the campus. Simultaneous sessions were held in the afternoon, one being devoted to metallography and the other to nonferrous metals and alloys.

Method for Polishing Specimens

Prof. C. Y. Clayton, head of the metallurgy department, Missouri School of Mines, presided at the session on metallography. Dr. S. R. B. Cooke, Missouri School of Mines, presented a paper on "Metallography of Cast Iron" in which he reviewed the methods used in polishing samples. He then described a method developed at the school for preparing polished specimens of cast iron, whereby the graphite contained in the specimen is polished with the matrix and is not torn out.

A very fine abrasive, consisting of alumina, two microns or finer in diameter, is used. A soft but not yielding lap is employed, made from pitch or vegetable rosin softened by addition of turpentine and beeswax. Prior to polishing, the samples are reduced with lead laps or emery paper of 0 to 0000 in grade. Dr. Cooke illustrated his talk with slides and a sample of the pitch lap.

The lap is driven in the machine at 60 revolutions per minute. The spindle which drives the holder, containing from 1 to 6 specimens, revolves at plus or minus 100 revolutions per minute. Dr. Cooke stated that it takes anywhere from 30 minutes to an hour to complete the polishing operation. However, since a number of specimens are polished at one time, the time per specimen is cut materially.

The second paper was entitled "Metallography, Its Technique and Application" was presented by S. C. Massari, Association of Manufacturers of Chilled Car Wheels, Chicago. The speaker pointed out that a knowledge of the structure of metals is far more important than the chemical composition, for it generally is realized that metal may have the same chemical analysis and yet be widely different in physical properties. The physical structure of metals is closely associated with properties, whereas chemical composition may have practically no association. Mr. Massari stated that in the chilled car wheel industry, through extensive work in the metallographic laboratory, a thorough understanding of the crystalline structure of the metal has been acquired. This has resulted in a material reduction in many of the different kinds of service failures and the establishing of newer methods of manufacture which have improved further the quality of the product.

Outlined Recent Developments

The speaker outlined recent developments of metallographic technique, and through the use of a number of slides showed application of metallography to gray and chilled iron. In closing he stressed the importance of foundrymen availing themselves of every possible advantage and facility to enhance the quality of the product to meet the exacting demands of present and future purchasers of castings.

The third paper was entitled "Some Notes on Microstructure of Cast Irons" and was presented by J. J. Picco, Sorbo-Mat Process Engineers, St. Louis. Mr. Picco first summarized the general impression concerning graphite in its relation to the physical properties of cast iron as well as to the service record. He then followed with a discussion of the desirability of the various graphite formations.

The speaker illustrated his discussion with a piece of soft iron which exhibited an inverse chill. He described the manner in which one formation developed into another and supplemented this with slides showing graphite as it exists in a number of test bars and castings. He concluded by emphasizing his belief that fine flake types of graphite uniformly dispersed and without a definite pattern are the best form for engineering castings.

In the discussion, V. A. Crosby, Climax-Molybdenum Corp., Detroit, pointed out that in cellular graphite formation, the casting has a lower deflection, a lower impact, a lower transverse, a lower resistance to wear, and a higher modulus of elasticity. With the flake graphite, the reverse is true, and a high resistance to wear is secured.

The simultaneous session on nonferrous metals and alloys was presided over by Francis T. O'Hare, Central Brass & Aluminum Foundry, St. Louis. A. Fritschle, Federated Metals division, American Smelting & Refining Co., St. Louis, presented a paper on "Nonferrous Metals and Alloys" in which he criticized the methods followed in many foundries in preheating a part of the charge. He pointed out that the metal never should come in direct contact with the furnace flame for any period of time, because metal allowed to soak directly in the fire becomes badly contaminated with harmful gases and the chemical reactions ruin the mix. By simply placing the pieces of metal on top of the furnace far enough away from the opening in the lid, so that the flame does not touch the metal, this difficulty will be eliminated.

Deoxidize With Phosphor-Copper

Because of the many variables in furnace and foundry practice, it is well for the foundryman to check closely on melting practice and to train the furnace tender in the best method of handling the work. It was recommended that every heat of red brass and tin bronze be deoxidized before tapping out any metal or pulling the crucible from the furnace. Phosphor-copper is the usual medium employed for the purpose, according to Mr. Fritschle. The phosphor-copper should be plunged immediately to the bottom of the molten metal and then stirred vigorously for a few seconds. The speaker pointed out that the use of gates or sprues as coolers frequently results in faulty castings, the defects having the appearance of cold shuts.

In the second paper of the nonferrous session, P. J. Myall, Fisher Furnace Co., Chicago, discussed the types, operation and maintenance of nonferrous melting furnaces. Mr. Myall presented a nontechnical discussion of electric, open hearth and crucible melting furnaces. He discussed the application of a specific furnace most suitable to the various requirements found in the nonferrous foundry. Slides were used to illustrate the features of oil and gas fired crucible furnaces. Particular reference was made to furnace linings of silicon carbide. The speaker also presented a comparison of melting costs on various types of furnaces, as well as the capital investment required.

The final paper of the nonferrous session was presented by C. C. Morgan, Bronzoid Corp., Dallas,

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ADVERTISING PAGES REMOVED

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Tex., and was entitled "Use of Plastic Bronze in Modern Bearing Applications." The speaker pointed out that bronze containing about 70 per cent copper, 6 per cent tin and 24 per cent lead perfectly distributed combines the best features of bronze and babbitt. He stated that the copper matrix provides ample strength to resist shock, the lead and tin give the necessary lubricant and plasticity requirements. With a perfect copper matrix, it was stated the principal danger rises from the tendency of lead, the least stable element present, to feed out too fast under severe service conditions and leave the copper matrix without protection.

Lead to Retard Crystal Growth

For that reason, it has been found worthwhile to purchase lead which has been specially treated to retard crystal growth. Bronze bearings now are in production with hardness in the neighborhood of 35 to 40 brinell, and with a compressive strength above 10,000 pounds per square inch. The speaker stated that microscopic examination of one of these bearings after severe service shows a thin film of lead-tin composition wherever metal to metal contact has occurred.

A dinner for conference visitors was held at the Edwin Long hotel on Friday evening, with George W. Mitsch, American Car & Foundry Co., St. Louis, as toastmaster. Dan M. Avey, secretary-treasurer of the American Foundrymen's Association, Chicago, presented the principal address of the evening. Mr. Avey extended greetings of the A.F.A. officers and directors, pledged support to the extension of the chapter movement, emphasized the work of the various committees, and announced that a second edition of the Cast Metals Handbook is in the making. Mr. Avey then read the address of Hyman Bornstein, president of the A.F.A., who was unable to be present.

Robert E. Kennedy, technical secretary of the A.F.A. stressed the number of workers taking an active part in association activities. William R. Chedsey, director of the Missouri School of Mines, extended a cordial invitation for the association to hold a second conference at the school next fall. Prof. Charles Y. Clayton of the metallurgical department spoke of the value of the conference to the staff and students of the Missouri Schools of Mines. Prof. Clayton stated that he expects to take his senior class to Cleveland in May, 1938 to attend the annual convention and exhibition of the American Foundrymen's association.

The toastmaster then introduced the committee members of the St. Louis chapter who arranged the conference; as well as George S. Haley, chairman of the St. Louis chapter; Harold W. Johnson, Greenlee Foundry Co., Chicago, and chairman of the Chicago chapter; J. D. Burlie, Western Electric Co., a director of the Chicago chapter; V. A. Crosby, Climax Molybdenum Co., Detroit, and chairman of the membership committee, Detroit chapter; and Frank G. Steinebach, THE FOUNDRY, Cleveland, and a director of the Northeastern Ohio chapter. Entertainment arranged by C. R. Culling, Carondelet Foundry Co., St. Louis, was provided following the dinner.

L. E. Everett, Key Co., East St. Louis, Ill., presided at the steel session on Friday morning. In a paper entitled, "Current Basic Open Hearth Practices at the Granite City Works of the American Steel Foundries," John W. Porter described in detail the procedure employed in his firm's furnaces from the time the new lining is installed to tapping a heat of steel, and repairing the bottom for the next heat. He discussed such phases as preparation of the furnace bottom, building up the bottom, charging the heat, refining the heat, finishing the heat, tapping, and repairing the bottom.

Steel Made in Electric Furnace

He concluded that by use of a uniform charge from heat to heat and by control of refining operations, it is possible to produce consistently the highest grade of steel to meet requirements on composition, and physical and other properties. Pig iron, scrap, slag forming materials, and fuel should be analyzed, and each charge made in a standard manner relative to quantity and composition. Through those, the heat melts uniformly, and the tapping time can be forecast accurately.

L. K. Bartholic, St. Louis Steel Casting Co., St. Louis, presented a paper on "The Electric Furnace in the Steel Foundry Industry," in which he pointed out that during the past 25 years, electric steel foundries have increased production steadily until at present about one-third of the total steel produced for castings is melted electrically. He stated that nearly all furnaces for casting purposes are acid lined due to the availability of raw materials suitable for acid melting. Suc cessful operation of the electric furnace demands skilled labor, and one of the greatest factors in advancement of the electric furnace steel foundries is due to the intelligent and skillful handling of high temperature metal.

Methods used in the production of low alloy steel castings parallel so closely the methods used in producing high grade carbon steel castings, that it is difficult to differentiate between production of the two types, according to T. N. Armstrong, International Nickel Co., New York, who discussed "Some Factors in the Production of Alloy Steel Castings." Differences in the properties are due primarily to the alloys. Mr. Armstrong pointed out that many of the defects occurring in steel castings may be traced back to improper deoxidation practice, and care must be exercised to obtain the best results. After the steel has been poured into molds there is little difference between the behavior of carbon steels and alloy steels. Alloys affect the green casting in much the same manner as increase in carbon, although there is considerable difference in the hardening power with different alloys. For example, a composition containing 0.20 per cent carbon, and 2 per cent manganese should be handled similarly to a carbon steel containing 0.45 per cent carbon, and a 0.20 per cent carbon—2 per cent nickel steel similarly to a plain 0.30 per cent carbon steel.

"Importance of Maintenance to Foundry Operations," was the topic of a paper by Carter Bliss, Scullin Steel Co., St. Louis, in which the author pointed out the value of having available the necessary spare parts, etc. to effect repairs within the shortest possible time. He also recommended study of the parts which wear out rapidly to see if they be replaced with something more permanent. Frequent inspections should be made to detect wear which may cause trouble later on, and catching a breakdown in any equipment before it comes pays big dividends in any equipment.

Value of Competent Master

In his talk, Mr. Bliss mentioned numerous problems which have occurred in his plant, and how they have been overcome. He said that with a sand elevator, the best quality belt money can buy pays for itself in the long run, and that with an inclined belt, it is advisable to use troughing rolls rather than a flat belt with aprons. He concluded his remarks with the statement that one essential in proper maintenance is an efficient master mechanic—one who never gets excited, knows what to do when a breakdown occurs, always has a new part ready to replace the broken one, and seems to have the faculty of knowing where to look for the trouble.

The session on gray irons and alloys, under the chairmanship of Webb L. Kammerer, Midvale Mining & Mfg. Co., St. Louis, attracted considerable interest. The first paper, entitled "Requirements of a Good Base Iron for Alloying," was presented by David B. Reeder, Electro Metallurgical Sales Corp., Chicago.

Mr. Reeder emphasized that in considering the metallurgical requirements for a suitable base iron for alloying, it is essential that the service requirements of the casting be known definitely. Machinability, high strength, abrasion resistance, freedom from growth, retardation of attack by various chemicals, and increased resistance to oxidation, are perhaps the major considerations and having a bearing on the choice of a base iron which will give most satisfactory results.

Add Alloys to Base Iron

The speaker outlined the improvements in properties which may be secured through the addition of various alloys to a proper base iron. Chromium is added to stabilize the structure and promote uniformity of cross section. Nickel is added to harden the matrix slightly through refinement of pearlite, and to prevent the formation of free carbides. Molybdenum also refines the pearlitic structure and increases the strength, the effect being greatest in the low carbon irons. Generally, chromium is added in combination with either nickel or molybdenum, as this simultaneous addition results in definite strength increase, slightly higher hardness, but with little or no loss in machinability. Mr. Reeder then outlined the numerous applications for alloyed gray irons.

V. A. Crosby, Climax-Molybdenum Corp., Detroit, presented a practical discussion entitled "Melting Requirements." Mr. Crosby pointed out that it would be just as hard to produce a low-strength iron consistently as to produce a high strength iron time after time. His experience in visiting many foundries has illustrated the fact that it is difficult to get foundrymen to agree on the many details of cupola practice. Uniformity is the goal in producing any type of iron, and the question involved, according to the speaker, is getting set up to do the same thing each day. Unless uniformity of practice is followed, uniformity of iron cannot result.

Mr. Crosby then outlined a number of points which require attention, in producing both special irons for castings such as piston rings, and for regular types of castings. He pointed out that in a short heat, it is not necessary to pay particular attention to the slag hole. At the same time, in producing hard iron, it is necessary to have a larger tap hole so that it will not freeze up. Another point he stressed was the temperature of the iron. Mr. Crosby stated that if cupola iron is too hot, something can be done with it, but if it is too cold, it cannot be used. He also stated that the size and amount of graphite in the material charged has a pronounced effect on the size and shape of graphite that comes through in the finished casting.

The final paper of the session was entitled "Some Practical Uses of Alloys in Cast Iron," and was presented by Carl Morken, Carondelet Foundry Co., St. Louis. Mr. Morken stated that the alloys used in cast iron may be divided conveniently into three groups: (1) Those metals and metalloids inherently present in cast iron and which may be said to be natural constituents; (2) those metals which are added to cast iron to create a change in its properties, and which, largely remain in the metal as constituents; and (3) those metals which are added to cast iron to change its properties, and which largely disappear during commercial reaction and are not residual in appreciable quantities .

Mr. Morken then discussed the addition of such elements as nickel, chromium, molybdenum, vanadium, titanium, etc. and the results which may be obtained through the application of the alloys. The speaker also discussed the use of several types of deoxidizers. In conclusion, Mr. Morken pointed out that the more vigorously acting an alloy becomes when added to iron, more care is necessary in its use. The use of alloys, according to the speaker must be mixed with common sense.

F.E.M.A. Meets at White Sulphur

Foundry Equipment Manufacturers' association held an interesting meeting at White Sulphur Springs, W. Va., Oct. 18 and 19, with about 75 per cent of the sales volume of the membership represented. Discussions at the first session centered around pending wage and hour legislation, the importance of increasing the supply of skilled labor, and the ever increasing number of expenses which must be met by industry. In the latter connection, Herbert S. Simpson, president, National Engineering Co., Chicago, pointed out in detail the excessive taxes assessed against a company doing business in Illinois by federal, state and local taxing units.

A general survey of business conditions by those present indicated that the average business for the group during the first 9 months of 1937 was approximately 72 per cent ahead of the sales during the similar period in 1936. Further reports indicated foundry business rather spotty, with a divergence of opinion among castings manufacturers as to the probable demand for cast products during the next few months. Several branches of the industry, including agricultural implement and automotive are busy. Reports were made by various committee chairmen. A paper "What About Advertising" was presented at the final session by J. M. Lathrop, advertising manager of THE FOUNDRY. Mr. Lathrop outlined the various forms of advertising which may be employed by the equipment manufacturer, and stressed the valuable features of each. Interesting motion pictures taken by W. F. Piper, Beardsley & Piper Co., Chicago, on his recent trip around the world were shown Tuesday morning.

The members discussed the value of more frequent meetings and voted to meet in the future in the spring and fall, as well as in February for the annual meeting. R. S. Hammond, Whiting Corp., Chicago, is president of the association. H. S. Hersey, C. O. Bartlett & Snow Co., Cleveland, is vice president, and Arthur J. Tuscany, Tuscany, Turner and Associates, Cleveland, is executive secretary.

New Refractories Are Developed

A new series of refractories adapted particularly for use in high temperature furnaces and in contact with corrosive materials has been developed recently at Mellon institute, Pittsburgh, according to Dr. E. R. Weidlein, director. The new refractories were evolved through research of Dr. A. P. Thompson, incumbent of the Abrasive fellowship, in co-operation with the research laboratories of the Carborundum Co., Niagara Falls, N. Y. The refractories are produced in the electric furnace, and cast into blocks. Several large scale installations of the refractories have been made in construction of glass melting furnaces and of furnaces for handling molten slag. Performance has been successful, according to reports, and it is expected that the materials will find application in other types of furnaces.

Has New Location

Hutton H. Haley & Associates, recently has moved into its own building located at 2918 East Grand boulevard, Detroit. The firm represents the American Foundry Equipment Co., Ajax Flexible Coupling Co., Aerovent Fan Co., and Allen Billmyre Corp. Hutton H. Haley & Associates includes Hutton H. Haley, Ralph J. Hutchinson, William P. Bleil, M. D. Chamberlin, and Charles T. Rutledge.

ADVERTISING PAGES REMOVED

OBITUARY

FERDINAND F. SCHAUER, president, National Casting & Pattern Co., Brooklyn, N. Y., died Oct. 14 at his home.

♦ ♦ ♦

Henry D. Kennedy, 70, owner, the Kennedy Foundry & Mfg. Co., Mansfield, O., died at his home in Columbus, O. recently.

♦ ♦ ♦

Percy C. Brooks, 65, former executive vice president of Fairbanks, Morse & Co., Chicago, died at his home in that city on Oct. 15.

♦ ♦ ♦

Thomas P. Kinney, 56, general superintendent of the American Brake Shoe & Foundry Co., Denver, died Oct. 20. He was a native of Atchison, Kans.

♦ ♦ ♦

Theodore E. Golden, president, Golden Foundry & Machine Co. and the Lumis Cotton Gin Co., both of Columbus, Ga., died Oct. 8 at his home in that city.

♦ ♦ ♦

Benjamin F. Slack, 84, until 10 years ago acting head of the Benjamin F. Slack Brass Mfg. Co., Denver, died in that city on Oct. 7. Mr. Slack was a native of Ohio and went to Denver 45 years ago.

♦ ♦ ♦

A. H. Vahldich, 95, pioneer foundry and machine shop owner, Chilton, Wis., died recently. He established a foundry business in 1887 and was active in its management for many years.

♦ ♦ ♦

Edward D. Doney, 72, retired manufacturer, Waupun, Wis., died recently. In 1910 he purchased the Althouse & Wheeler Foundry & Machine Co., Waupun, conducting it until the business was acquired by the Shaler Co. several years ago.

♦ ♦ ♦

Fred A. Kurtz, 46, connected with the W. S. Tyler Co., Cleveland, for 30 years, died at his home in Cleveland on Oct. 7. Mr. Kurtz had risen from telegraph operator to the office of assistant vice president, the position which he held at the time of his death.

♦ ♦ ♦

John E. Gilson, 59, president, J. E. Gilson Co., Port Washington, Wis., died recently. Mr. Gilson was connected with his father in the Gilson Mfg. Co., specializing in chairs and furniture hardware cast pieces. He served as vice president until the interests were sold in 1914. A few years later he founded the J. E. Gilson Co.

♦ ♦ ♦

Ernest J. Seiber, 65, assistant manager of the Pittsburgh works, Standard Sanitary Mfg. Co., subsidiary of the American Radiator & Standard Sanitary Corp., died Oct. 4 at his home in Pittsburgh. He had been associated with the company for more than 30 years.

♦ ♦ ♦

Charles E. Hildreth, 70, for many years engaged in the manufacture of machine tools in Worcester, Mass., died in that city recently. Mr. Hildreth was a graduate of Amherst college, class of 1892, and was formerly active as a member of the New England Foundrymen's association, and the National Metal Trades association.

♦ ♦ ♦

Thomas Allsop, 71, Philadelphia, a machinery manufacturer, died at his home in that city recently after a short illness. Mr. Allsop came to the United States from England when he was 21 years old and 11 years later was a partner in organizing the Philadelphia Drying Machine Co. He was its president at the time of his death.

♦ ♦ ♦

Fred W. Priep, 68, president of the Laclede Stoker Co., St. Louis, and former alderman of Clayton, Mo., died recently at Lutheran hospital in St. Louis. Mr. Priep was born in Germany and came to this country as a child with his parents. He moved to St. Louis in 1900 and 4 years later organized the Tower Grove Foundry Co., which later became the Laclede Stoker Co.

♦ ♦ ♦

Richard W. Douglass, 60, former sales manager, Ingersoll-Rand Co., New York, died recently in Madison, Wis. Mr. Douglass managed the Seattle office of the company before going to New York as sales manager in 1920. In 1929 he became a special representative, the position he held at the time of his death. Mr. Douglass had been with the Ingersoll-Rand Co. for 27 years.

♦ ♦

John F. Keller, 75, nationally-known steel specialist with the engineering extension department, Purdue university, Lafayette, Ind., died at his home in that city on Oct. 28. Born in Ireland in 1861, Mr. Keller came to the United States at the age of 9. He became a blacksmith in the shops of the Big Four railroad, Indianapolis, and later was made foreman of the blacksmith shop, Nordyke & Marmon Co., Indianapolis. In 1905 he became an instructor in the forge shop of Purdue. He left in 1919 to serve for 1 year as a special representative for a steel company. Then for 2 years he was on the faculty of Lewis institute, Chicago. About 11 years ago he took his present position with Purdue, during which time he lectured extensively. For a brief period, while on leave of absence, Mr. Keller served as director of the extension division of the American Society of Metals and organized numerous lecture groups in Ohio, Pennsylvania and Indiana. In 1920 he was elected president of the Steel Treating Research society, which was amalgamated with the American Steel Treaters' society to form the American Society for Steel Treating.

♦ ♦ ♦

Arthur John Ramsay, 63, who rose from a roll turner to a vice presidency of the Pittsburgh Rolls Corp., a division of the Blaw-Knox Co. at Pittsburgh, died Oct. 31. Born in England, he came to the United States in 1890 and worked for the American Steel & Wire Co., at Cleveland, the Illinois Steel Co., Joliet, Ill., and the Bethlehem Steel Corp., Bethlehem, Pa.

♦ ♦ ♦

Franklin P. Gurney, 85, formerly a part owner of the Central Iron Foundry, East Boston, Mass., died at his home in that city recently. He served an apprenticeship as a machinist and later became connected with his brother in operating and owning the foundry, succeeding his father who had established the company in 1853. Mr. Gurney had been in business about 35 years when the foundry was sold to the Gurney Heater Co. of Toronto.

♦ ♦ ♦

Thomas Johnson, 75 who on various occasions contributed articles to THE FOUNDRY, died Aug. 20 at his home in Brunswick, a suburb of Melbourne, Australia. As a young journeyman molder, Mr. Johnson spent some time in the United States, before returning to his home in Australia where he established a jobbing gray iron foundry and conducted it up to a short time before his death. Among his other activities he was prominent in civic affairs and a member of the Brunswick Council for nine years.

Policyholders' Service bureau, Metropolitan Life Insurance Co., 1 Madison avenue, New York, recently has published a bulletin entitled "Employe Contacts Through the Bulletin Board". The survey reports on reasons for and against the use of bulletin boards, subject matter which may be posted to best advantage, selection of locations, number of boards, construction and size, etc.

VIEWING FOUNDRY DEVELOPMENTS AT SHORT RANGE

THE common practice of preheating part of the nonferrous crucible charge by placing it on top of the furnace where the flame strikes it, is an extremely expensive procedure because the metal becomes oxidized and absorbs gases of combustion, and results in defective castings. Never permit the flame to come in contact with the metal being preheated.

* * *

In the final polishing of cast iron specimens for metallographic examination, the work can be accomplished on a lap covered with short nap velveteen, and either rouge or levigated alumina in water serves as the abrasive. The lap should rotate at approximately 300 *revolutions per minute, and polishing on the lap should be continued only until the specimen is scratch-free. Further polishing tends toward relief polishing or the removal of soft nonmetallic inclusions, such as graphite.*

* * *

After steel has been poured into molds there is little difference between behavior of carbon steels and alloy steels. Certain precautions must be taken with certain types of compositions, but it will be found in most cases that the carbon content is the controlling factor. It is well to keep in mind that alloys affect the green casting in much the same manner as increase in carbon although there is considerable difference in the hardening power with different alloys. For example, a composition containing 0.20 per cent carbon and 2.0 per cent manganese should be handled similarly to a carbon steel of approximately 0.45 per cent carbon; a chromium-molybdenum steel of an analysis similar to S. A. E. 4130 will be comparable in the green state to a steel containing 0.55 per cent carbon, and a 0.20 per cent carbon-2.0 per cent nickel steel can be handled like a plain 0.30 per cent carbon steel.

* * *

One of the greatest causes of trouble with the brick lining of a cupola is excessive blast. A high pressure blast will oxidize some of the iron, and the resulting iron oxide is very corrosive to the lining.

* * *

MICROSCOPIC examination of a 70 per cent copper, 6 per cent tin, and 24 per cent lead bearing after severe service showed a thin film of a lead-tin composition wherever metal to metal contact had occurred. That in effect forms a babbitt type bearing surface immediately backed by a strong, tough copper matrix. Field tests indicate that the copper-tin-lead alloy causes only about one-third the wear on journal surfaces normally caused by commercial babbitt.

* * *

When a large or deep hole occurs in the bottom of a basic open-hearth furnace care should be taken to rabble it out clean, and to dry it up with bottom materials. After drying, the hole is filled up wth thin layers of bottom materials each addition being sintered until the hole is built up to the bottom level.

* * *

Important factors in determining the life of a cupola lining are the size of heats melted, length of time the cupola is operated each day, and the temperature of the metal tapped. High percentages of steel scrap with their higher melting temperature decrease life of brick in the melting zone. Steel scrap should be in small pieces so that it will not divert the blast against the lining. Fluxing materials such as limestone and fluorspar should be kept at least 6 inches away from the lining.

* * *

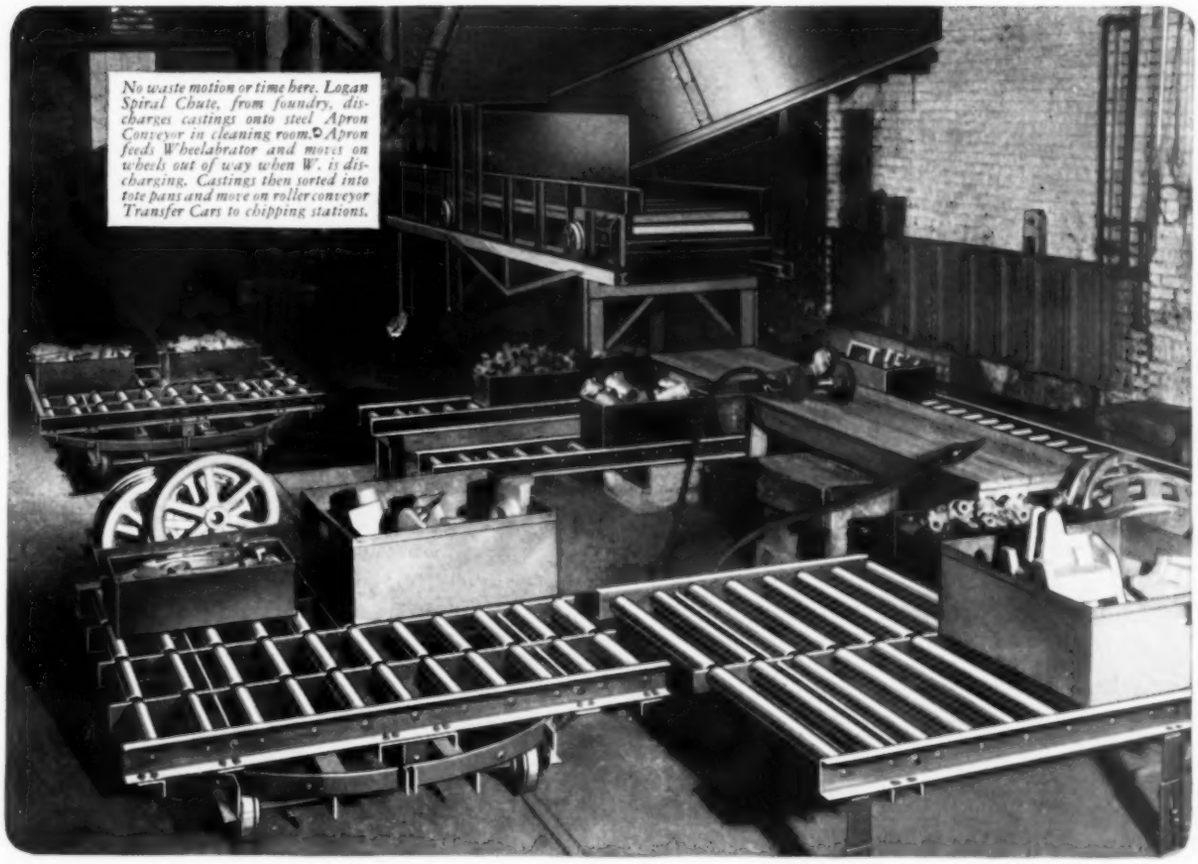
Introducing phosphor-copper into molten metal is important, and to a considerable extent controls the results obtained. It should be added 4 *or* 5 *minutes before pulling the pot or tapping the furnace, and some type of holder should be used so that the phosphor-copper can be plunged immediately to the bottom where it is stirred vigorously for* 5 *or* 6 *seconds.*

* * *

Continued impact of abrasive materials against the walls of abrasive blast cleaning rooms wears them so that repairs have to be made from time to time. However, much of the trouble now can be eliminated by lining the walls with special rubber slabs which have been compounded to resist the action of abrasive materials.

* * *

SINCE the action of soda ash slags employed for desulphurization are rather severe on linings for reservoirs and ladles, a special refractory brick has been developed which is said to give excellent results with a refractory cost slightly below 5 cents per ton. Suggested application employs a 4½-inch lining over a 4½-inch lining of regular firebrick, except at the slag line, where it is increased to 9 inches.



No waste motion or time here. Logan Spiral Chute, from foundry, discharges castings onto steel Apron Conveyor in cleaning room. Apron feeds Wheelabrator and moves on wheels out of way when W. is discharging. Castings then sorted into tote pans and move on roller conveyor Transfer Cars to chipping stations.

Waste Elimination

★ ★ ★ COUNTS!

WASTE MOTION and *waste time* are prime enemies of low-cost production. And the foundry, large or small, that keeps these wastes to a minimum has a real *competitive* advantage. . . Hundreds of foundries use Logan Conveyors to do away with needless energy and time in handling flasks through molding, pouring, cooling and storage—and to handle castings and tote pans through cleaning, grinding and machining operations. . . Logan systems not only eliminate waste throughout these operations, but put a profitable flow into production from start to finish. Which means if you don't use conveyors you are probably doing it the hard way. The nearest Logan engineer is at your service, or write for Bulletin 15.

Logan Foundry Bearing is in protected position—set back from end of roll. All-steel seals.

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LOUISVILLE

Poor souls look more like heels

The Adventures of Bill

—by Pat Dwyer

A COUPLE of weeks ago, the last night of October to be exact, I met Bill at what playfully was known as a hard time Hallowe'en party. All bright little boys and girls know on the night of Oct. 31, witches, hobgoblins and all manner of untouchables float through the air with the greatest of ease and cover a much greater territory than ever was possible to that other famous floater, the graceful and daring young man on the flying trapeze.

Under the circumstances one might assume, might one not, that a good stiff suit of armor, with extra reinforcement at the joints and crevices, would be a more appropriate costume than a nondescript suit of hand me downs.

On the other hand, to be perfectly fair and impartial, one may assume that the old clothes disguise is planned deliberately to throw dust in the eyes of these ghostly creatures of the night. Without putting too fine a point on it, I have seen better costumes on scarecrows in the corn field than were draped around some of the guests at the party. Also, and this possibility may touch at the root of the matter, some of the costumes were even more dilapidated and scanty at the close than they were at the beginning of the festivities.

In a reminiscent mood, Bill contrasted present and past methods of celebrating a day originally set apart for fasting and prayer, the eve of the feast of All Saints.

"This is the night," he said, "when bright little boys and girls of a former generation bobbed apples, played post office, puss in the corner and other more or less innocently interesting household games.

"Other boys, big and little, bright as the proverbial new pin in their own estimation, but dim nitwits and dumb young potential criminals in the eyes of the neighbors, ran themselves ragged from nightfall to midnight in hilarious defiance of all rules and regulations touching on the sacredness of the ordinary citizen's person and property.

"They hung tick-tacks on the windows and pressed their grimy thumbs with great enthusiasm and frequency on door bell buttons. When the indignant householder appeared, frothing at the gills, they bombarded him with pea shooters from across the street and other coigns of vantage.

"By the way, I wonder why that instrument vanished? I have not seen one for 30 years or more. In the good old days every boy had one of these deadly blow guns up his sleeve and a supply of hard peas in his pocket for amunition. Ready for offense or defense. Mostly offense. I almost wish I had one now!"

"Too close in here," I said, "for really good work. Forget it."

Tommy gun men in the making

"I guess you're right," he admitted reluctantly, "too close. No pleasure where there is no risk.

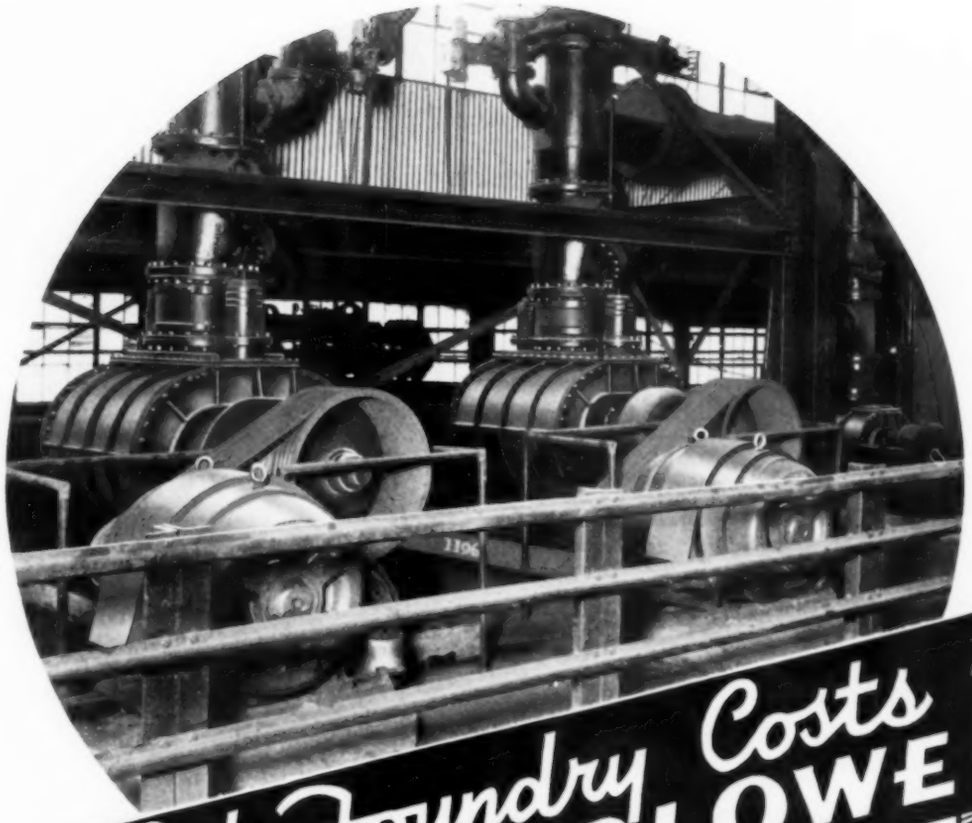
"The old gang I have in mind dislodged gates, front steps and sections of fence, and at the expense of incredible labor, and at imminent risk of breaking their little yellow necks, hung them, the gates and things, on the branches of trees or on the cross arms of telegraph poles. They erected the livery stable sign on the lawn of the leading citizen. Usually they wound up the night's program by snaring a goat and shoving it through the window of the high school. Where no goat was available, they compromised on a half grown calf or a sizable pig.

"Of course I may be wrong, but I have a settled conviction that the flames of many a big game hunter's imagination, the desire to commit mayhem, to inflict grievous bodily harm, to actually murder wild animals in many instances was lighted at one of these wild push and pull Hallowe'en adventures. A jumping pig pulls no punches.

"On a mathematical basis, ten healthy young devils should experience no difficulty in lifting and pushgin a 200-pound pig through a window 4 or 5 feet above ground level. Presented in the usual manner the problem resolves itself into dividing 200 pounds, the weight of the pig, by 10, the number of boys in the party. Practically every boy if driven hard enough could work out that problem on the blackboard. Some of the real clever lads without leaving their seats could figure the thing out without touching chalk or pencil. With a great snapping of fingers these mental giants were prepared to announce that the answer was 20 pounds per lifter.

"Absolute candor compels the statement that while all the boys

(*Concluded on page* 62)



Cut Foundry Costs with ROOTS BLOWERS..

Air, controlled as precisely as the charge that goes into the cupola, and in the exact measured volume needed for proper combustion, cuts melting time, saves coke, and reduces scrap losses. The sustained high efficiency of Roots-Connersville Rotary Positive Blowers lowers power costs as well.

Manually or automatically controlled to give constant weight of air, Roots-Connersville Positive Blowers are the modern foundry blower equipment. They are helping many foundries step up both quality and quantity of output while reducing costs.

Three Roots-Connersville blowers shown above, recently installed in a large Birmingham cast iron pipe foundry, help that modern plant keep their costs down. As builders of both Positive Displacement and Centrifugal Blowers we are free to make recommendations on either type. More than 80 years of research and development contribute to "KNOWING HOW".

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(*Concluded from page 60*)
could work the problem and arrive at the answer 20, some of them, the mentally fuzzy but keenly alert and skilful pea shooter lads in the back row, were not sure whether the 20 meant pigs or pounds, boys or feet, or merely represented the day of the month.

"However, as you probably were going to remark, all that merely is digression and as the legal boys express it in much more extended form, irrelevant to the point at issue.

"Any person above the age of 14 and who presumably by that time has learned to do short division can prove conclusively that if 10 boys lift a 200-pound pig, each boy will have to lift only 20 pounds. A trifle not worth mentioning. Unfortunately in this as in many other problems susceptible to absolute proof on paper, one important factor has not been taken into consideration."

"Don't tell me. This is one of these for want of a nail the shoe was lost and all that kind of stuff. I give up. What was the priceless ingredient omitted from the thrilling problem of the pig and the pusher?"

"The pig was alive, my boy, very much alive!

"Filled apparently to the bursting point with powerful steel springs, and presenting an impervious hide as hard and smooth as the shell of a torpedo, the animal was just about as easy to capture, manipulate and control as one of these deadly projectiles in full flight.

"Usually classed as a quadruped, the beast in some mysterious manner developed more legs and feet than a centipede and every foot packed the speed and wallop of a riveting gun. Stumbling home wearily after the job was completed, cut and bruised, with clothing in a disreputable condition and smelling to high heaven, the boys resembled nothing so much as a cross between the last survivors of the wrath of God and the wreck of the Hesperus. The inevitable working out of the law of compensation may be responsible for the fact that on the following day all aches and pains were forgotten. Partly through the pride which your true craftsman takes in a job well done, and partly through the pleasure they experienced in listening to the coment of the principal and members of the school board."

"Seems to me," I said, "that the eminent naturalist and highly entertaining writer, Mr. Ernest Seton-Thompson, overlooked a natural when he failed to include in his well known *Wild Animals I Have Known*, one of these squealing, kicking, twisting, animated hunks of dynamite, a Hollowe'en pig getting shoved against his will through a high school window."

New scholar does not seem to appreciate opportunity to acquire education

"Well," said Bill, "I'll tell you. Your hyphenated friend may know a thing or two about wild animals, but if he never helped to handle an obstinate, peevish or downright angry pig—Shucks. He ain't seen nothin' yet.

"Talking about old times and the younger generation and one thing or another," Bill continued, "here is something you might smoke a pipe or two over. An editorial I clipped from a Mid-West paper recently. It is headed *Country Schools Go On* and opens with the statement that in the past two years the state department of education has saved a million dollars by eliminating 941 country schools. This represents progress and therefore is a good thing.

"The old boy carefully balances a chip on each shoulder, dips the editorial pen in his favorite mixture of ink, prussic acid and vinegar and goes on with elaborate sarcasm:

The country school house is a symbol of our ignorant past, of the days when we crammed our children's heads full of fundamentals and overlooked entirely such fine points of education as care of the nails and eyelashes, intimate hygeine and how to apply for a job.

Children often finished the eighth grade with no notion whatever of supervised play, vanity cases, make-up kits, permanent waves or the fine art of mixing cocktails. Before and after school they wasted precious hours wandering through the fields and woodlots checking up on present and last year bird nests; lying in wait with a snare for a gopher; combing the roadside for wild strawberries or competing to see who could eat the most wild onions and other horrible, but exceedingly toothsome trifles with absolutely no reference to their vitamin content.

Then there was the school house itself, about the size and shape of a two-car garage, fitted up with rows of double seats where timid little brothers, copper toed shoes dangling, often sat with big sisters until brave enough to go out alone; thoroughly grounded in the double standard of civilization which ordains that the boys shall use one path while the girls use another.

Children drank well water out of the same battered tin dipper; exchanged bites from their sandwiches at noon, swapped gum with each other, dried their hands on the same towel and otherwise laid themselves wide open to infection, affection, introspection and all other forms of contagion with which their clean, healthy little bodies were afflicted.

In this demoralizing atmosphere youngsters just naturally grew up ignorant and innocent. They learned nothing about lip stick and rouge, the importance of wearing clothes to match one's personalty, how to choose a career, or how to get by with a minimum of mental and physical effort. The softies allowed their parents to boss them around. They went out into the world with old fashioned ideas of kindness, honesty and courtesy, of belief in the Golden Rule and they saw no reason why they should not work hard to get ahead.

"After reading the foregoing," said Bill, "and finding it good, the old sourpuss takes another dip in the ink bottle and winds up bitterly:"

That is what the country school was doing to the younger generation in this country, SO—we must do away with the country schools! Besides, we SAVE a million dollars.

"Well," I admitted. 'Ye Ed wields a trenchant and nimble pen. I wonder if he is an ex-school teacher. It would be interesting to turn back the files of his paper and read what he may have said the morning after Hallowe'en many years ago when he entered the school and found that the same young paragons had shoved a pig through the window."

ADVERTISING PAGES REMOVED

Detroit

DETROIT chapter of the American Foundrymen's association held its regular meeting on Oct. 21 at the Fort Shelby hotel, with 56 members present. Immediately after dinner a rather informal round table discussion was held on cupola practice, core room practice, and molding practice, with Harry Rayner, Tony Gonter and Leslie Korte as discussion leaders.

L. B. Knight Jr., vice president, National Engineering Co., Chicago, was the principal speaker of the evening, talking on "Sand Reclamation, Conditioning and Control in the Foundry." With the aid of lantern slides, Mr. Knight presented a clear description of the various sand handling and conditioning installations and problems encountered in various types of foundries. R. B. Crawford, chairman of the chapter, presided.

New England

APPROXIMATELY 65 members and guests attended the regular meeting of the New England Foundrymen's association, held Oct. 14. James D. Coltman, Bullard Machine Co., Bridgeport, Conn., spoke on "A Machine Tool Foundry."

Mr. Coltman presented his talk in an interesting manner to start a practical discussion, and discussed various practices of melting and founding as carried out at his plant. He spoke at length on the subject of cupola operation, explaining that three cupolas of varying sizes, were employed and the two largest were equipped with forehearths. Mr. Coltman went on to say that he had received continued improvement by the use of soda ash in the cupola. He also added that present practice of a melting zone lined with firestone was economical and satisfactory. In discussing foundry practice, he mentioned that much of the large work was being made in dry sand or core molds, and considerable interest among those present was aroused by his explanation of pouring a fairly large casting in a core mold without a flask.

The speaker discussed cleaning room and cleaning operations, describing in detail the hydraulic method of cleaning. He showed figures where the cleaning time for one type of casting was reduced from 27 hours to 3½ hours when the hydraulic method was employed. He added that in addition to reducing the cost of cleaning castings, this method showed practically 85 per cent recovery of the sand, and resulted in a cleaning room very free from dust.

One of the disadvantages, however, of the method is that certain large castings could not be cleaned as soon after pouring by this method as by the conventional method. He cited an instance where one type of casting had to be cooled nearly a week before allowing water to be put on it. Mr. Coltman's talk was informal, and many questions were asked throughout the evening. The speaker described a new core oven, thermostatically controlled for drying cores which he said had contributed to an appreciable coke saving. He also related his experience with a centrifugal type sand muller, which recently was purchased and thus far has proved satisfactory.

Chicago

OPENING meeting of the 1937-1938 season for the Chicago chapter, American Foundrymen's association, was held at the Medinah club, Oct. 11, and was designated as Executives' Night. More than 100 members and guests attended.

R. S. Hammond, Whiting Corp., Harvey, Ill., gave a brief greeting to executives present, emphasizing the value of the activities of the chapter.

"Man Power and Earning Power" was the subject of the principal address, presented by Dan M. Avey, secretary-treasurer, American Foundrymen's association. Mr. Avey stressed the relationship between adequate and efficient man power and the earning power of the foundry industry. He urged the adoption of training programs designed to provide a sufficient supply of skilled employes.

The Chicago chapter's annual outing and golf party, held Oct. 2 at the Lincolnshire Country club, attracted the largest attendance in the history of the organization. About 650 participated in the event, 300 engaging in the golf tournament. Golf prizes were distributed among 45 individuals at the dinner, which concluded the program.

A special lecture course will be conducted again this year by the Chicago chapter. Fundamentals of foundry practice will be covered and will be presented so as to appeal particularly to shop men, apprentices and students. Meetings will be held in the auditorium of the Peoples Gas building. J. J. Fox, Wisconsin Steel Works, is chairman of the lecture course committee.

Pittsburgh

PITTSBURGH Foundrymen's association heard H. J. Rowe, technical control and development engineer, Aluminum Co. of America, Cleveland, on the subject of "Founding Aluminum Alloys," at its meeting in the Fort Pitt hotel, Pittsburgh, on Monday evening, Oct. 18.

The speaker discussed thermal and electrical characteristics of aluminum, resistance to atmospheric corrosion, and pointed out that aluminum alloys are readily machined and polished.

Copper, silicon, zinc, manganese, nickel, and iron are among the materials most commonly used as hardeners. He pointed out that the method of casting, whether in sand or metal mold, has considerable influence on strength and that choice of heat treatment is important. Of the aluminum casting alloys in use today, those containing copper

are most numerous. Aluminum silicon alloys find a large use, he said, while alloys containing magnesium machine with ease. Special foundry technique is required in the use of certain alloys.

Low specific gravity and high crystallization shrinkage are other characteristics possessed by aluminum alloys, Mr. Rowe said. In sand casting, sand control is important for best results. It is well known and proven that strength is dependent to a great extent upon proper gating methods, Mr. Rowe pointed out. Trouble may be eliminated by proper location of gates and proper use of risers and chills. Chills should not be used indiscriminately.

Discussing benefits of pouring at low temperatures, Mr. Rowe asserted that the general tendency is for the properties to drop off as the temperature is increased. Aluminum, unlike ferrous metals, does not reflect its temperature by colors and temperature recording equipment is required. The X-ray is an efficient tool for inspecting castings. Mr. Rowe closed his talk with typical aluminum foundry scenes and views showing applications of aluminum. An interesting discussion followed the lecture.

The association discussed the new Pennsylvania state 44-hour law, which is scheduled to take effect Dec. 1, following the appointment of a committee by President H. M. Wilson to voice objections to provisions of the measure. Foundrymen feel the law would be a definite hardship in some of its regulations. Maintenance and repair work would be complicated while in the middle of a heat, new crews would be required at the end of 8 hours. Lunch periods must be rigidly adhered to and heavy fines are proposed for violations of the law. W. H. White is chairman of the committee, which will include H. A. Houston, J. H. Johnston, F. C. T. Daniels, and A. M. Cadman.

Milwaukee

MILWAUKEE chapter of the American Foundrymen's association held its regular meeting on Oct. 15 at the Schroeder hotel, with 136 attending. Walter Gerlinger, Walter Gerlinger Inc., and chairman of the chapter, presided.

An interesting program was furnished by the Waukesha Motor Co. consisting of colored films showing various steps in the manufacture of Waukesha engines and a discussion of casting problems encountered in the machine shop. The following subjects were discussed: "Castings from an Inspection Standpoint," by H. Krueger, inspection department; and "Castings from a Manufacturing Standpoint," by A. Herzberg, superintendent. A scheduled paper on castings from an engineering standpoint, by J. B. Fischer, chief engineer, was abstracted by Carl Nelson, due to the absence of Mr. Fischer who was unable to be present.

W. J. Donnelly presented an A.F.A. seal ring to W. F. Bornfleth, past chairman in appreciation of his services to the chapter. Then Mr. Bornfleth presented a gavel and gong to Walter Gerlinger, chairman, as a gift from the present board of directors to the Milwaukee chapter.

Mr. Morrissette, Milwaukee Vocational school, addressed the meeting to outline the evening course for foundry workers which will be offered by that institution.

Northern Iowa

NORTHERN Iowa Foundrymen's association held its regular meeting Oct. 5 at Waterloo, Iowa, with 40 present. W. R. Jennings presided.

Ralph M. Johnson, Norton Co., Worcester, Mass., discussed grinding problems, illustrating his talk with motion pictures showing the products of his company.

Connecticut

ON OCT. 19 the Connecticut Nonferrous Foundrymen's association held its second meeting at the Duncan hotel, New Haven, Conn. The meeting constituted a roundtable discussion of nonferrous foundry problems, and the speakers were W. J. Kenney, North & Judd Mfg. Co., New Britain, Conn., who spoke on "Foundry Practice for Nonferrous Hardware Castings," and Benjamin Stewart, Bridgeport Deoxidized Bronze Co., Bridgeport, Conn., who spoke on "Foundry Practice for Bearing Bronze Alloys." Both speakers drew upon their long experience, and presented much valuable and interesting information which evoked considerable discussion.

The tentative program for the remainder of the 1937-1938 season for the Connecticut Nonferrous Foundrymen's association is as follows:

November—"Effect of Impurities in Red Brass and Methods of Determination"; December—"Short Business Meeting, Christmas Party and Entertainment"; January — "Brass Forgings and Die Castings Versus Sand Castings"; February — Joint meeting with American Society of Mechanical Engineers, subject: "Design and Alloy Specifications for Nonferrous Castings"; March — "Foundry Problems—Discussion of Questions and Problems"; April — "Cost Methods and Records"; May —"Finishes on Brass, Bronze and Other Nonferrous Alloys"; and June —"Annual Entertainment".

Northern Illinois

MOTION pictures showing old and new methods and equipment in use in the foundry and core room of the Fairbanks-Morse Co., Beloit, Wis., were presented at the first fall meeting of the Northern Illinois Foundrymen's association on Sept. 14, by C. V. Nass, president of the association.

L. H. Rudesill, Griffin Wheel Co. Chicago, was the featured speaker at the Oct. 12 meeting held in Beloit, Wis. Mr. Rudesill's subject was "The Influence of Melting Mediums and Alloy Additions on the Properties of Cast Iron." The speaker stated in part that the proper selection of melting stock is necessary to secure good results in the cupola. Height of coke bed and amount of flux to be used for gray iron and steel were discussed, and the cupola practice employed at the Griffin company was outlined. Mr. Rudesill discussed the influence of coke and cupola design on the final product. As an added attraction, motion pictures showing the San Francisco Bay bridge under construction, were presented.

A nominating committee was appointed to nominate candidates for the election to be held at the November meeting, and is composed of the following: August Christen, Arcade Mfg. Co., Freeport, Ill.; H. J. Halverson, Beloit Foundry Co., Beloit, Wis.; J. E. McCrummey, Swan-Finch Oil Corp., Chicago; Oscar Anderson, Gunite Foundries Corp., Rockford, Ill.; and H. E. Rupp, Lind Pattern Works, Rockford. F. B. Richards, National Sewing Machine Co., Belvidere, Ill., vice president of the association, presided at the meeting.

Birmingham

THE first fall meeting of the Birmingham District chapter was held Oct. 15 at the Tutwiler hotel, Birmingham, with 75 members present. Chairman R. R. Deas, Jr., American Cast Iron Pipe Co., opened the meeting. Secretary-treasurer R. C. Harrell, Stockham Pipe Fittings Co. read the minutes for the month of May and June, and in the latter thanked member A. S. Holberg, Alabama Clay Products Co. for the splendid barbecue and outing given to the chapter and its guests at the Jessie James' camp on the Cahaba river during that month.

Chairman Deas presented the new members who had been appointed to committees including, publicity committee, Harry Mouat, Whiting Corp., chairman, and Biddles Worthington, McWane Pipe & Foundry Co.; reception committee, Charles Wegelin, Dixie Bronze Co., chairman, and William Oberhelman, Hill

(*Continued on page* 68)

"BILL" SAYS

"Every foundryman should be reading THE FOUNDRY. So, my good man, I suggest you present your men with Christmas Gift Subscriptions this year. Send it to their homes where they will have time to read and enjoy the instructive articles presented. A Gift Subscription is an investment for you."

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PENTON BUILDING · CLEVELAND, OHIO

(*Continued from page* 66)

& Griffith Co., Joe Gilbert, Stockham Pipe Fittings Co., Walter Miller, Miller Foundry Co., and J. S. Bridges, U. S. Pipe & Foundry Co.; attendance committee, T. H. Benners, Jr., T. H. Benners & Co., chairman, and A. S. Holberg, Alabama Clay Products Co., Arthur Woody, American Cast Iron Pipe Co., William Oberhelman, Hill & Griffith Co., and Tom Bellsnyder, Jefferson Foundry Co.

J. E. Reynolds, vice chairman of the program committee spoke upon the fine prospects for future programs of the chapter, and T. H. Benners, chairman of the membership committee, reported 31 new affiliate members and 9 new firm members bringing the total to 203 members in the chapter.

Following the various announcements the meeting was turned back to Mr. Reynolds, who introduced John M. Kane, American Air Filter Co., Louisville, Ky. Mr. Kane presented an illustrated talk on "Dust Control in the Foundry." Types of dust found in the foundry were discussed, and the methods of eliminating them as hazards to the health of foundrymen were shown by slides. After Mr. Kane's talk, a lively discussion occurred.

Philadelphia

METROPOLITAN Philadelphia chapter of the A.F.A. held its first meeting of the 1937-38 season on Oct. 8 at the Engineers club, Philadelphia. Harold Henszey, chairman of the chapter, presided.

J. S. Spencer, chairman of the membership committee, stressed the importance of increasing membership in the chapter. Dr. G. H. Clamer, Ajax Metal Co., and past president of the A.F.A. spoke briefly.

The principal address was presented by L. J. Trostel, chief chemist, Baltimore laboratories of the General Refractories Co. Mr. Trostel showed that the continued advances of the foundry industry are creating more severe requirements for refractories and stimulating interest in the newer refractory materials. Slides were used to show the various basic properties of refractories which define their spheres of usefulness by reference to the action of iron oxide, a common constituent of many foundry slags, on aluminum silicate refractories, as well as reference to the mechanics of spalling. The speaker stated that high density in brick is related to so many other desirable properties and therefore is a controlling factor in eventual usefulness. A brief description was given on the manufacturing changes made to achieve that property.

Applications of the new refractories to various foundry furnaces were pointed out. Refractories described included super duty fireclay brick exhibiting negligible change in volume at high temperatures and having high resistance to spalling; crystalline base refractories made from imported ore of high density and possessing spalling resistance; insulating firebrick of high refractory value; and basic brick of high resistance to spalling. Mention also was made of the improvements in the manufacture of silica brick, high alumina brick and silicon carbide brick.

Reading

THE second regular meeting of the Reading Foundrymen's association was held Oct. 19 at the Wyomissing club, Reading, Pa., with 27 foundries represented. The membership committee reported that several new members can be expected at the next meeting, and the program committee stated that it had secured the services of some excellent speakers for meetings during the winter months.

The principal subject of discussion at the meeting was the Pennsylvania 44-hour week law which limits the hours of labor to 44 hours a week, and to not more than 8 hours in any day, and which will become effective on Dec. 1, 1937. A committee comprising Messrs. Greenstreet, Shomo and Laroche have been working with various interested groups with the idea of presenting a petition to the state department of labor and industry for exemptions to be granted under the law in case of emergencies such as occur from time to time in the operations of foundries.

It was felt by members of the Reading group that the case of the foundry industry generally could be presented ably by a committee representing all the foundry groups and the metal manufacturing groups in the state since their problems are similar. It was pointed out that manufacture of castings involves many uncontrollable variables which affect operations to such an extent that strict adherence to a predetermined schedules of hours is impossible. Unavoidable production peaks occur, due to customers' demands, particularly on breakdown or repair work, which may and often do, require extra time to be worked in the foundry.

Also, it was pointed out that often times there are unavoidable delays in the process of melting, pouring and many other operations of such a nature that normal foundry operations would be disrupted seriously by strict application of the act. However, since the law itself establishes a base of 44 hours a week, the consensus of opinion of the meeting was, that if exemptions could be secured, it would permit foundries to operate in excess of the maximum 8 hours per day as fixed by the law, in cases where emergencies occur, and that foundries could operate within the 44-hour weekly limit.

Northeastern Ohio

AN EXTREMELY lively and instructive session was held at the second meeting of the Northeastern Ohio Chapter of the A.F.A. which took place at the Cleveland club, Cleveland, on Oct. 14. Bertram G. Parker, Youngstown Foundry & Machine Co., Youngstown, O., and chairman of the chapter, presided, and introduced C. E. Hoyt, executive vice president, American Foundrymen's association, Chicago, who spoke briefly on the 1938 annual convention and exhibition of the association which will be held in Cleveland.

Mr. Hoyt stated that with the active co-operation of the Northeastern Ohio chapter, he believes that the coming convention will surpass any sponsored heretofore by the association. He also mentioned that the exhibition will open on Saturday afternoon instead of on Monday and the opening day will be designated Northeastern Ohio day with admission by special tickets which will be distributed without charge to foundries in the district.

Joseph F. Froggett, senior editor, *Daily Metal Trade*, Cleveland, presented the coffee talk, describing in an interesting and reminiscent way, the development of the iron and steel industry in Northeastern Ohio. He pointed out that it began in Youngstown, O., about 1802 or 1803 with the discovery of local ironstone ore deposits.

The main discussion of the evening was directed by Leroy P. Robinson, Werner G. Smith Co., Cleveland, and vice chairman of the Northeastern Ohio chapter, and related to various phases of core manufacture. In opening the discussion he pointed out that successful core making depends primarily upon careful consideration of eight variables. One is the proper selection of core sand since it is found that there is one particular sand which serves best for a given metal or alloy, and a given type of work. Cleanliness, uniformity of grain size, openness and refractoriness of the sand are essential qualities.

Selection of a proper binder is important. Free workability, reasonably quick bake, and maximum binding power are points to be kept in mind. Proper binder to sand ratio is another factor, and once determined it should be followed as closely as possible. Correct mixing

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is important, and it was pointed out that tensile strength of baked cores decreased with extended mixing. Lack of moisture control may result in poor workability of the core mixture, slow drying, and in cracked and split cores. Moisture should be maintained between 3 and 5 per cent except in the case where used in core blowing machines when it should be not over 2 per cent. Other variables to be considered are proper baking, proper venting, and proper inspection. It was stated that unless a core was as perfect as possible, it was cheaper to throw it away than to try to doctor it up for use.

One speaker mentioned that difficulties arising from use of pitch arose from lack of proper baking. Pitch has a melting point ranging from 280 to 300 degrees Fahr., and the interior of the core must reach and hold that temperature for a sufficient time to insure the desired reaction. Use of sawdust with pitch to provide a core which disintegrated rapidly after it had served its purpose also was described.

Mention was made of the effect of relative humidity on core making, and a prediction made that in the future, oven design would include air conditioning. It was pointed out that numerous tests in the Northern climate indicated that cores baked under the same conditions showed approximately 10 to 25 per cent higher strength from November to March than in the warmer months. Possibly that might be due to expansion and contraction of oil since the volume will vary according to the temperature. However, it was believed that the change in strength could be attributed to difference in atmospheric moisture content during baking.

Northern California

A REPRESENTATIVE group of foundrymen and wives from North and South met at the Fresno hotel, Fresno, Calif., on Oct. 9, as guests of Northern California chapter's new member M. G. Wilson, Wilson & Nutwell, Fresno. Forty-five were present to enjoy the hospitality and take part in a new movement among California foundrymen. Everyone responded with appropriate remarks bearing on the cause of the gathering, and the range of subjects covered many phases of interest to the foundry industry.

This was one of the rare occasions in California when foundrymen of the North and South were brought together by a small band of enthusiastic foundrymen in the agricultural center of the state, and although most of the men present were members of the association, it was not an official meeting.

Robert Gregg, chairman, Southern California chapter of the A.F.A. headed the delegates from the South, and John D. Fenstermacher, vice chairman, Northern California chapter, was responsible for a good representation from the northern district including, Stockton and Sonora. Charles Hoehn, a national director and chairman of the Northern California chapter, was not able to be present because of illness.

Speakers urged all California foundrymen and their ladies to attend the Del Monte conference of Iron, Steel, & Allied Industries on Feb. 10, 11 and 12.

Northern California Chapter of the American Foundrymen's association met on Oct. 15 at the Athens Athletic club, Oakland, Calif. John D. Fenstermacher, vice chairman of the chapter, presided. Reports were received from the various committee chairmen.

Harry W. Dietert, Harry W. Dietert Co., Detroit, was the principal speaker of the evening, talking on "Molding Sand." The fact that the speaker had just returned from a visit of industrial centers of Europe, increased the attendance and interest at the meeting. Mr. Dietert discussed both the practical and the technical phases of sand control.

The November meeting, to be held in San Francisco, is scheduled as "Old Times Night."

Reader's Comment

EDITOR'S NOTE—*Material Appearing Under this Head Does Not Necessarily Reflect the Opinion of The Foundry or of Its Editors.*

Better Wages

TO THE EDITORS:

I have read with a great deal of interest your editorial in the October issue of THE FOUNDRY, quoting the survey of the National Industrial Conference board on the training of apprentices, and commenting on the shortage of competent skilled labor in the metal working industries.

In the last paragraph of your editorial you give the average compensation for apprentices at 33 cents an hour for the first six months to 57½ cents an hour for the last half of the fourth year.

It seems to me that these wage rates answer the shortage of skilled labor as we, ourselves, were unable to keep apprentices on when we paid rates such as these. For a number of years past we have been working under a wage arrangement with apprentices that has proven entirely satisfactory. We start all apprentices at our common labor wage rate, which at present is 50 cents an hour. They are put on a three months' probation period at that wage rate and at the end of that time we decide whether or not they are suitable to the trade they have started, and the apprentice is interviewed to see if he likes the trade. Both of the above being favorable, his wage rate is increased two cents per hour and this wage rate is increased every three months two cents per hour. This, we think, is the answer to keeping apprentices interested and learning their various trades. We also think that we attract a better grade of apprentices by paying these rates and in the end we hope to raise the standard of the trades that we employ by training these higher grade apprentices.

We think that the metal working industries should give this matter of apprentice wages serious consideration, with the idea of eventually raising the standard of all the men employed in the industry.

A READER

Gas Reactions

TO THE EDITORS:

Some interesting points were raised in the paper "The Effect of Humidity on the Cupola," by H. V. Crawford in the September issue of THE FOUNDRY, regarding the gas reactions going on in a cupola and the heat quantities resulting from these reactions.

Water entering a cupola in the blast is broken down shortly after passing through the tuyeres according to the water gas reaction $H_2O + C \rightarrow H_2 + CO$. However, the H_2 is not re-combined with oxygen when leaving the bed coke because under the conditions of no free oxygen and excess hot carbon the reaction goes rapidly in the direction shown in the equation. Indeed, the H_2 cannot be oxidized until it rises high enough in the cupola to find free oxygen which would be near the charging door.

The net effect of the water gas reaction in the coke bed therefore

is to have H_2 and CO produced with an absorption of 3934 B.t.u. per pound of H_2O. Under the condition of the case cited in the above paper using 360,000 cubic feet of air per hour with 7 grains of H_2O in each cubic foot an absorption of 1,416,500 B.t.u. per hour would take place.

This absorption of heat occurs in the bed coke exactly where we do not want a reduction of heat. Then a reduction of heat generated in the bed of 1,416,500 B.t.u. out of a possible 20,007,000 B.t.u., to use the figures of the case cited in Mr. Crawford's article reduces the coke bed heat 7.08 per cent.

It should be remembered that a drop of 7.08 per cent in the bed heat has a much more drastic effect than reducing the cupola efficiency only 7.08 per cent.

If enough heat were generated in a cupola to cause a gas temperature of 2250 degrees Fahr. no metal would be melted assuming the melting point of the iron to be 2250 degrees Fahr. The effective heat for operation therefore is that generated to produce a gas temperature above the level of the melting point of the iron. That is the effective temperature of cupola bed bases at 3000 degrees Fahr. for example would be 750 degrees Fahr.

Factors Effecting Temperature

Let us see how a reduction of 7 per cent of the heat in the bed will affect the operation of the cupola. It will drop the gas temperatures about 5 per cent. But this reduction of temperature is measured in degrees Fahrenheit above zero, while the effective temperature is that above the melting point of the iron. To illustrate: If the furnace gases from dry air are at 3000 degrees Fahr. the effective temperature head is 750 degrees Fahr. above the melting point of the iron. If the gas temperature is reduced 5 per cent of 3000 degrees Fahr. then they will be lowered 150 degrees or become 2850 degrees Fahr. This means that the effective temperature head would then become 600 degrees Fahr. or it was reduced 150/750 or 20 per cent. That is to say, the melting rate is reduced 20 per cent by reducing the heat generated in the bed 7 per cent.

The effect of drying the blast in a cupola is similar to drying the blast for an iron blast furnace where the surprising effect of freezing the H_2O was found to be about 5 times more effective than the increase in heat generated in the furnace would signify. This was later explained by J. E. Johnson, Jr. that the reason for the marked increase of a blast furnace output upon drying the blast was due to the increase of the temperature above the melting point of the slag which is the crucial temperature level of the blast furnace. ("Applications of a Dry Blast to Blast Furnace Operation" by James Gayley, *Transactions* of the American Institute of Mining Engineers 1906; also discussion of this paper).

Attention should be called further to the impossibility of CO burning to CO_2 in the upper portions of the incandescent coke bed. Indeed CO_2 tends to break down to CO according to the reaction $CO_2 + C \rightarrow 2\ CO$ at the prevailing coke bed temperatures and in the presence of excess carbon.

Effect of Carbon Deposit

It should be borne in mind that some of the CO_2 issuing from the cupola charge is a result of carbon deposited from CO gas as it moves through the colder upper portions of the charge. The reaction of depositing C is $2\ CO \rightarrow CO_2 + C$. This reaction is especially noticeable when the cupola exhaust gas temperatures are relatively low. The effect of this carbon deposit is noted by the fact that the carbon absorption of the metal is increased with lower exhaust gas temperatures accompanied by an increase in the CO_2 CO ratio.

With lower exhaust gas temperatures the CO_2 increases, which will occur with an increase of the height of the stock column and with a decrease of rate of flow of gases through the furnace. Therefore, the percentage CO_2 issuing from the cupola charge is not necessarily an indication of the percentage CO_2 in the gases leaving the coke bed except when the temperature of the gases leaving the charge is over about 1500 degrees Fahr. when very little if any CO is changed to CO_2.

The author of the paper referred to previously speaks of "excess air in the cupola." To the mind of the writer there can be no such condition. Certainly due regard should be given to the rate of blowing air *into the coke bed* but this must be balanced with the desired melting rate and the proper height of the coke bed.

If the air blast is increased the rate of generating heat (melting rate) will be increased and the height of the bed must be increased to have the melting zone just above any point to which free oxygen may rise. Conversely upon decreasing the air blast the melting rate decreases and the height of the bed should be lowered.

In a cupola the air will come to that ratio between CO and CO_2 which is controlled by the coke bed temperatures and the velocity of the air blown into the cupola.

Regarding combustion in a cupola at least five factors should be taken into consideration.

1. The melting rate is primarily dependent upon the rate of generating heat which is mainly dependent upon the rate of blowing oxygen into the cupola tuyeres.

2. CO_2 is unstable in the coke bed due to the high temperatures.

3. The per cent of CO_2 in the flue gas issuing from the top of the charge is not necessarily an indication of the combustion efficiency in the coke bed as the CO is converted back to CO_2 with a deposition of C when the temperature of the gases in the upper portion of the charge is low enough.

4. H_2O entering the cupola in the blast is broken down to H_2 and CO which gases are not oxidized again in the bed. This reaction causes an absorption of heat in the bed thus producing lower temperatures and a slowing up of the melting rate.

5. The temperature of the cupola gases above the melting point of the iron should be regarded the temperature head which controls the melting rate of the cupola. Slight variations of the temperature of the gases produce marked variations of the temperature head and of the melting rate.

FREDERICK G. SEFING
The International Nickel Co.
Bayonne, N. J.

Holds Open House

Pangborn Corp., Hagerstown, Md., held an open-house and housewarming for the families of its employes on Oct. 2. More than 1600 persons enjoyed the hospitality and freedom of the Pangborn plant. Each family group was welcomed personally by Thomas W. and John C. Pangborn. At noon a cafeteria style luncheon was served each person.

Prints Year Book

American Society for Testing Materials, 260 South Broad street, Philadelphia, recently has published a Year Book which includes information about the society, a list of members, the personnel of the various committees, society representatives, past presidents, past and present officers, charter, by-laws, and numerous regulations.

Sands, Clays and Minerals, published by A. L. Curtis, Westmoor laboratory, Chatteris, England, carries several articles of interest to the foundry industry, in the September issue. These include the following: "Beryllium and Its Alloys," by L. Sanderson; "A New Meter for Clay and Mineral Dusts and Its Applications," by E. G. Richardson, and "Bentonite—Its Use in Industry," by James N. Wilson.

FOUND

in the

MODERN FOUNDRY...

10,000 pound locomotive cylinder, one of a pair produced from Nickel Cast Iron. For its properties, see chart below.

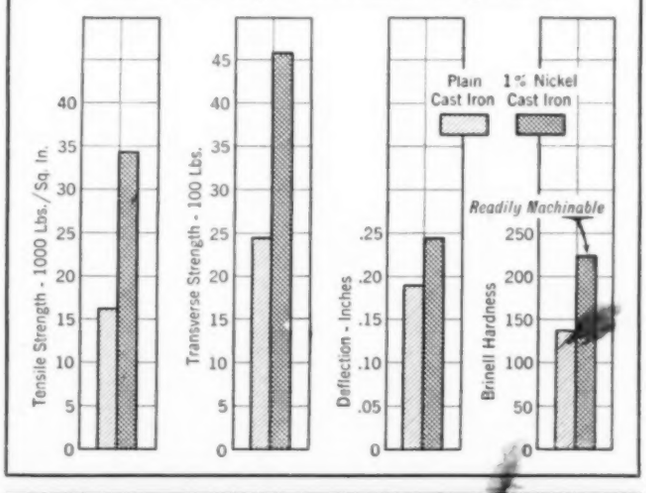
...a New Method to test

BIG JOBS

The Results of the New Method

(Tests Made in 4" x 18" Bars)

Physical Properties of Plain and Nickel Cast Irons Suitable for Locomotive Cylinders



NICKEL CAST IRON

● When a foundry recently cast two 10,000 pound locomotive cylinders like the one above, they discovered how to compare *accurately* the difference in properties between plain cast iron and a cast iron alloyed with 1% Nickel.

These large castings cool slowly. To approximate this rate of cooling, tests were made not in bars 1.20" or 1.50" dia., as ordinarily, but in test bars 4" dia. x 18" long.

It's no news to you that a small addition of Nickel gives a more uniform grain structure, with greater resistance to wear and shock. But to see *just how great* are the differences, look at chart at the left.

The new test bars illustrated clearly that these improvements of Nickel are even greater in large castings than in small. In a 1.50" test bar, the increase in tensile strength of Nickel Cast Iron over plain cast iron was 50%; but in the 4" bar, the gain was 100%!

• • •

These cylinders offer one striking example of the way the modern foundry is enlarging its scope, by constantly studying the results of new and improved alloys. Nickel increases effectiveness here, as in many other jobs. Consultation on your casting problems involving the use of Nickel is invited.

THE INTERNATIONAL NICKEL COMPANY, INC., 67 WALL ST., NEW YORK, N.Y.

Steel Founders Consider Various Activities

STEEL Founders' Society of America held its fall meeting at the Homestead hotel, Hot Springs, Va., Oct. 15 to 19. Attendance was excellent with over 100 steel foundrymen present. At the first general session, reports dealing with various phases of the society's operations were presented. Clarence Tolan Jr., Dodge Steel Co., Philadelphia, chairman of the advertising committee, reviewed the work accomplished during the past year and recommended a sizeable appropriation for trade paper advertising and that funds be made available for products and process research work.

It was reported that Harold S. Falk, Falk Corp., Milwaukee, chairman of the apprentice training committee, is at work on a suggested procedure which can be followed by foundries desiring to train new men for skilled and semiskilled operations. W. J. Corbett, Atlas Steel Casting Co., Buffalo, chairman of the cost committee, presented a report on the work which is being done by that committee in developing uniform general principles of job costing for the steel foundry industry. An industry-wide survey is being conducted to determine what practices are now being followed by steel foundries throughout the country.

Develop Cost System

After analyzing present methods, the committee will undertake to develop a method of determining the cost of producing castings from any given pattern, the proposed new system to be constructed in such a way as to cause the least possible change in method for the majority of the industry. With the assistance of an accurate cost finding procedure it is anticipated that foundries can determine which patterns are profitable, which are not, what classes of castings the foundry is best equipped to produce, and similar information. Special effort is being made to keep the new method as simple as possible, free from red tape, and requiring the minimum of clerical effort.

C. L. Snowdon, Reliance Steel Casting Co., Pittsburgh, chairman of the definitions and classifications committee, reviewed the work of that committee during the past year and announced the intention of the committee to hold a meeting within the next several weeks for the study of the entire list of classifications. This is being done for the purpose of eliminating duplications, clarifying certain items, and otherwise revising the entire list, prior to the opening of the first quarter of the new year. It was announced that the operating data reports committee is engaged in studying the various grades of steel scrap purchased by foundries for the purpose of devising a standard, comprehensive list of such material that can be used in reporting purchase prices on operating data reports.

Reports on Specifications

E. W. Campion, Bonney-Floyd Co., Columbus, O., reported for the technical specifications committee, outlining its work during the past year. The committee was requested to study and report on the status of federal specifications, the question of radiographic inspection and other matters in which members of the industry expressed special interest.

The meeting discussed in detail the general question of proposed maximum hours-minimum wages legislation now pending in Congress. The following resolution, adopted by unanimous vote, summarizes the feeling of the majority of the industry with regard to such legislation:

"Whereas we are in accord with the professed objectives of the legislation pending before the Congress of the United States, dealing with maximum hours and minimum wages, we are of the opinion that, in addition to involving restrictions of the liberty of the individual in his right of contract, these matters are of such a complex economic nature that they cannot be dealt with properly or effectively by governmental edict or regulation; therefore

"Be it resolved that the Steel Founders' Society of America record its conviction that this type of legislation is not in the interests of industry, the wage earner, the consuming public or the nation as a whole."

F. A. Lorenz Jr., American Steel Foundries, Chicago, and president of the society, discussed various phases of the industry today. He emphasized the importance of figuring costs on every job. He illustrated the position of the industry with charts, showing the production, cost and average selling prices and pointed out the desirability of each foundry making use of the society's statistics. Mr. Lorenz praised the industry on the fact that about 97 per cent of the tonnage is represented in the society's statistical reports, and asked for greater co-operation in connection with the operating data and labor data reports.

James A. Emery, general counsel, National Association of Manufacturers, Washington, addressed the meeting on "Federal Control of Employment Relations."

The annual meeting of the society will be held in Cleveland, Feb. 9, 1938.

Establishes Four Fellowships

Ferro Enamel Corp., Cleveland, has established four new fellowships located at Case School of Applied Science, Cleveland; University of Illinois, Urbana, Ill.; Ohio State university, Columbus, O., and Alfred university, Alfred, N. Y. This supplements the Cushman fellowship at Western Reserve university, Cleveland, established by the company in 1924.

This year the Cushman fellowship has been granted to Nelson Perry Nies, who is working under the direction of Dr. H. S. Booth on the fundamental reactions involved in porcelain enamel frits. At Case, R. R. Schauss is studying the factors relating to suitable cast iron for leadless enameling. The fellowship is under the direction of Dr. A. C. Coffinberry and Dr. H. A. Schwartz of the metallurgical department.

At the University of Illinois, Dr. A. I. Andrews is directing the work of Thomas L. Hurst who is studying "Physical and Chemical Study of Soluble Salts Present in Mill Liquors, Including Their Relation

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to Total Solubility and Selective Crystallization on Drying."

At Ohio State university, Warren B. Felter is studying "Sagging: Causes of and Methods of Elimination," under the direction of R. M. King. Wilfred Paquin, Alfred university, is working on "Studies of Domestic Clays and Clay Blends; Methods of Improving Clays for Porcelain Enamel," under the direction of Dr. C. R. Amberg.

The Ferro Enamel Corp. also is a contributor to the fellowship which is being carried on under the direction of the Porcelain Enamel institute.

Foundry Equipment Is Displayed At Olympia Exhibition

By VINCENT DELPORT

European Manager THE FOUNDRY

A FOUNDRY trades exhibition was held at Olympia, London, England, from Sept. 16 to Oct. 2 in conjunction with the Engineering and Marine exhibition. Coleman Foundry Equipment Co. Ltd., Letchworth, Hertfordshire, showed a jolt-ram, squeeze, pattern-draw molding machine in which the piston rings in the cylinder are of a circular section, permitting the piston to go up and down without any jerks. On the same stand was a new abrasive cut-off machine and various types of molding machines, core sand mixers, a coke-fire furnace melting 200 lbs. of metal in 35 minutes with 25 lbs. of coke, and various other items of equipment.

Rapid Core Blowing Machine

Constructional Engineering Co. Ltd., Titan Works, Birmingham, had among its new specialties a core-sand mixer and a core blowing machine. A feature of the core blowing machine is that the air and the sand are mixed in a chamber before blowing. It is claimed that with this machine from 80 to 85 gas-ring cores can be made in one hour. Another new exhibit was a gas-fired crucible furnace. The design of this furnace embodies the complete separation of the fuel gases from the metal and a new type of burner which, with the system of pre-heated blast, is claimed to secure great economy of fuel. The firm showed its cupolette, spark arrestor, sandblast machine, etc.

William Cumming & Co. Ltd., Glasgow, Scotland, exhibited a hand-ram molding machine for flasks of maximum size, 15 x 15 inches, which machine consists of a turnover table with one side machined to accommodate the ordinary type of pattern plate used on machines of this kind. There is a locking device for retaining the turnover table in position while the mold is being rammed, and this device also retains the table in the reverse position while the pattern or mold is being drawn. On the same stand was a new sand mixing machine in which the sand is totally enclosed and it is impossible for the mixture to reach the bearings. The firm displayed its coke-fired movable furnace, and various grades of facings, blackings, parting powders, etc.

Rapid Magnetting Machine Co. Ltd., Magnet Works, Birmingham, displayed a new portable magnetic separator for ferrous and nonferrous foundries. This separator can be fed either by shovel or in conjunction with a rubber belt conveyor. All loose iron and steel contained in the material is held magnetically against the face of the conveyor when passing over the drum, until the bottom position is reached. At the point where the feed belt leaves the drum, the separated iron is discharged automatically into a separate receptacle. The firm also showed, for the first time in London, a self-cleaning chute type electro-magnetic separator.

Show Separators and Magnets

Electromagnets, Ltd., Birmingham, exhibited its rotary drum type separator for dealing with mixed ferrous swarf; a chute type of separator for dealing with liquids; a jig shaker type of chute separator for extracting fine iron and oxides from powders. On the same stand the firm also demonstrated a 36-inch diameter lifting magnet equipment suspended from an electric pulley block.

On the stand of Tilghman's Patent Sand Blast Co. Ltd., Broadheath, near Manchester, was a working model of a centrifugal abrasive blast, rotary type machine, and another for handling flat castings without the use of compressed air. Working in conjunction with the latter machine was the firm's latest type of dust-arresting units, which is made in various sizes and can be applied to overcome almost every dust problem.

British Moulding Machine Co. Ltd., London, displayed a turnover type of molding machine which has a simultaneous jolt-squeeze of the shockless type, with pneumatic turnover and pneumatic pattern draw. Another turnover type of machine is a jolt-squeeze machine of the anvil type, with compressed-air turnover and pattern draw. There was also a straight-draw machine, jolt-squeeze of the anvil type, with oil-operated pattern draw, a plain jolter of the anvil type, and a number of hand-operated machines.

The firm of Spermolin, Ltd., Halifax, Yorkshire, in addition to exhibiting its specialties in core oils and a sand-mixing machine and core-extruding machine, showed a new plastic stone for making patterns and pattern-plates. It is claimed that this composition neither expands nor contracts and will withstand the hardest wear.

Wide Range of Refractories

General Refractories, Ltd., Sheffield, showed a comprehensive range of samples of molding and silica sands for the foundry, and several types of basic and neutral refractories. These included two types of basic refractory bricks having as a basis chrome-spinel. Both bricks are of similar composition, but with different physical characteristics; one being designed for the bottom part of the lining, from the hearth to the slag line, and the other for the upper structures. Plastic refractories for cupolas, ladles, soaking pits, pit fires, tilting furnaces, etc., and for the monolithic lining of steel converters and rotary furnaces, were shown on the stand of Thomas E. Gray & Co. Ltd., London. On the same stand was a model of the special refractory accumulator which forms part of the "British Herrmann" system. In a drying stove this accumulator is built over the firebox so as to provide a large area for the rapid absorption of heat.

Coming in the class of special exhibits was the stand of Ernst Leitz, London, which displayed a number of optical instruments for use in the laboratory, particularly metallographic microscopes. Other specialties were shown on the stand of Sterling Foundry Specialties, Ltd., Sterling Works, Bedford, which firm exhibited a comprehensive selection of rolled steel molding boxes of various sizes and styles, and wheelbarrows suitable for foundry and other industrial purposes. Ransomes, Sims & Jefferies, Ltd., Orwell Works, Ipswich, Suffolk, displayed electric battery-driven industrial trucks for internal transportation of materials in the foundry. The Fordath Engineering Co. Ltd., Hamblet Works, West Bromwich, Staffordshire, exhibited a range of core oils, rotary core machines and core-sand mixers.

On the same stand was a core cut-off machine which enables cores to be trimmed to any desired length.

Laidlaw, Drew & Co. Ltd., Edinburgh, Scotland, showed a new oil-fired ladle heating equipment, and fuel oil burners for lighting cupolas, firing core-drying ovens, drying molds, preheating castings, etc. The Yale & Towne Manufacturing Co., Willenhall, Staffordshire, exhibited a range of material-handling equipment.

Many exhibits showed actual castings, one of the most interesting being that of The International Meehanite Metal Co. Ltd., London, on whose stand were castings and photographs illustrating the applications of Meehanite for machine tool, diesel and oil engine, laundry machinery, railroads, and numerous other industries.

Ford Motor Co. Ltd., Dagenham, Essex, displayed a printing roll of the following composition: Total carbon 2.90 per cent; silicon 1.40 per cent; phosphorus 0.30 per cent; manganese 0.65 per cent; sulphur 0.09 per cent, made from the firm's pig iron and steel scrap machined to a "mirror" finish for use in printing machinery. Stewarts and Lloyds, Ltd., of Glasgow, Birmingham and London, showed working models of springs made from the company's pig iron, together with typical examples of their products, some of which were shown with enamel finishing. In addition, there were a number of steel castings, steel sections and tube strip from the Stewarts and Lloyds' foundries and steelworks.

Samples of pig iron, raw materials, etc., were also displayed by the following firms: Bradley & Foster, Ltd., Darlaston Blast Furnaces, Darlaston, Staffordshire; Thomas Wilkinson & Co. Ltd., Stockton Street, Middlesbrough, Yorkshire; William Baird & Co. Ltd., 168, West George street, Glasgow, C-2, Scotland; British Pig-irons, Ltd., Abbey House, 2, Victoria street, London, S.W.1; Dorman, Long & Co. Ltd., Zetland road, Middlesbrough, Yorkshire; G. & R. Thomas, Ltd., Hatherton Furnaces, Bloxwich, Staffordshire.

Two Day Conference Is Arranged For Cornell University

A FOUNDRY conference sponsored jointly by the Buffalo chapter of the A. F. A., the foundrymen of Northwestern New York, Cornell university, and the American Foundrymen's association, will be held at the university, Ithaca, N. Y. on Nov. 26 and 27. The committee on arrangements comprised of Chairman A. C. Davis, mechanical engineering department, Cornell university; H. B. Hanley foundry manager, American Laundry Machinery Co., Rochester, N. Y.; R. K. Glass, Republic Steel Corp., Buffalo, N. Y., and H. H. Judson, foundry superintendent, Goulds Pumps Inc., Seneca Falls, N. Y., has prepared an excellent program for discussion.

All meetings except the laboratory demonstrations will be held in Willard Straight hall, the social center of Cornell university. A registration and information booth will be maintained in the lobby of the hall from 7 a. m. Thursday, until the close of the conference, and information relating to train schedules, hotel reservations, and other accommodations will be available at the booth. All meetings will be conducted informally with plenty of time for discussion, and outstanding men in the foundry field will assist the chairmen in bringing out points for discussion.

The opening meeting will be held at 9 a. m. on Nov. 26, when those attending the conference will be welcomed by S. C. Hollister, acting dean, college of engineering. Following that, two sessions will be held in the morning; one on foundry sands, over which Dr. H. Reis, Cornell university, will preside; and the other on alloy cast irons under the direction of H. H. Judson, Goulds Pumps Inc., Seneca Falls, N. Y. At 12:30 p. m., a luncheon will be held at which Dexter S. Kimball, dean emeritus, college of engineering, Cornell university will speak. In the afternoon two sessions on steel castings and malleable cast iron will be held with T. H. Burke and R. K. Glass, as the respective chairmen.

In the evening, a banquet will be held at 7 p. m. at which Dan M. Avey, secretary-treasurer of the A. F. A. will preside. Speakers will include Dr. E. E. Day, president, Cornell university; H. B. Hanley, foundry manager, American Laundry Machinery Co., Rochester, N. Y., and Cameron Beck, director, the New York Stock Exchange institute. On Saturday morning, Nov. 27, the first session on nonferrous castings will open at 9 a. m. under the direction of Chairman A. Lockwood. At 10:30 a. m., a session on cupola practice will be held under the direction of Chairman A. E. Wells. Those sessions will be followed by a luncheon held at 12:30 p. m., at which the speaker will be R. E. Kennedy, technical secretary, A. F. A. At 2 p. m. laboratory demonstrations will be held on materials testing by various methods. The complete program as tentatively arranged is as follows:

Thursday, Nov. 25

7:00 p.m.—Registration for early arrivals.

Friday, Nov. 26

8:00 a.m.—Registration.

9:00 a.m.—OPENING MEETING.
Welcome by S. C. Hollister, acting dean, college of engineering Cornell university.
FOUNDRY SANDS.
Chairman, Dr. H. Ries, geology department, Cornell university.
"Mixing and Blending of Foundry Sands" (Iron, Steel and Nonferrous), by L. B. Knight, vice president, National Engineering Co., Chicago.
"Facing Mixtures for Gray Iron, Malleable Iron, Steel and Nonferrous Castings," by Norman Dunbeck, Eastern Clay Products Inc., Eifort, Ohio.

11:00 a.m.—ALLOY CAST IRONS.
Chairman, H. H. Judson, Goulds Pumps Inc., Seneca, Falls, N. Y.
"Practical Aspects of Production of Alloy Cast Irons," by R. G. McElwee, Vanadium Corp. of America, Detroit.

12:30 p.m.—LUNCHEON.
Speaker, Dexter S. Kimball, dean emeritus, college of Engineering. Cornell university.

2:00 p.m.—STEEL CASTINGS.
Chairman, T. H. Burke, Otis Elevator Co., Buffalo, and chairman, Buffalo Chapter A. F. A.
"Modern Developments and Trends in Steel Catsings," by V. T. Malcolm, metallurgist, The Chapman Valve Co., Indian Orchard, Mass.
"Steel Foundry Practice," by W. J. Corbett, works manager, The Atlas Steel Casting Co., Buffalo.

3:30 p.m.—MALLEABLE IRON.
Chairman, R. K. Glass, Republic Steel Corp., Buffalo.
"Malleable Iron Castings," by J. B. Deisher, plant manager, The Columbia Malleable Casting Corp., Columbia, Pa.

7:00 p.m.—BANQUET—Willard Straight Hall, Cornell Campus.
Presiding—Mr. Dan Avey, secretary-treasurer, American Foundrymen's association.
Speakers—Dr. E. E. Day, president, Cornell university; H. B. Hanley, foundry manager, The American Laundry Machinery Co., Rochester, N. Y., and Cameron Beck, director The New York Stock Exchange institute.

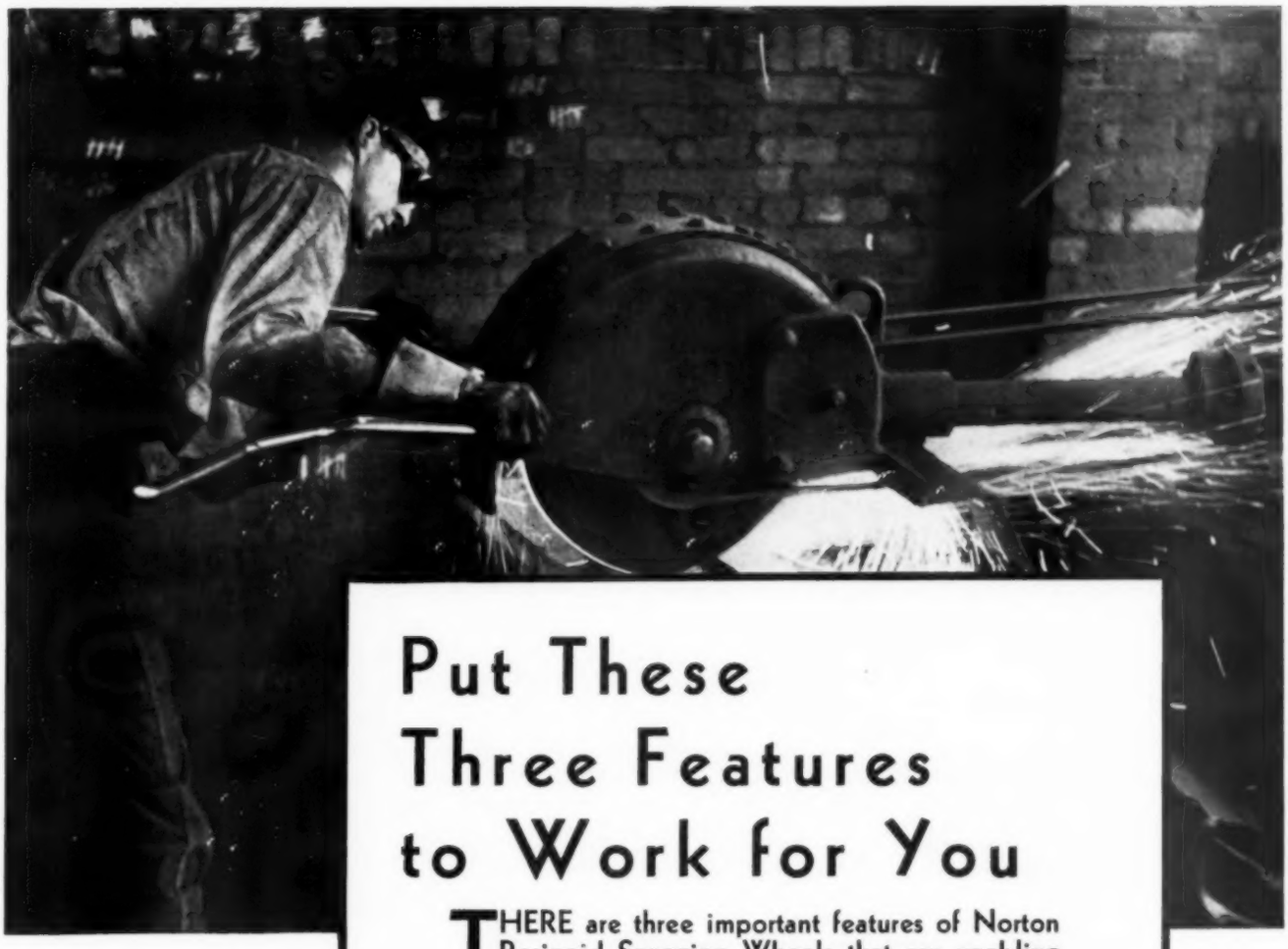
Saturday, Nov. 27

9:00 a.m.—NONFERROUS CASTINGS.
Chairman, A. Lockwood, Lumen Bearings Co., Buffalo.
"The Role of Silicon in Nonferrous Castings," by H. W. Gillett, technical advisor, Battelle Memorial institute, Columbus, O.

10:30 a.m.—CUPOLA PRACTICE.
Chairman, Prof. A. E. Wells, department of mechanical engineering, Cornell university.
"The Cupola Melting Process," by Donald J. Reese, foundry engineer, development and research division, International Nickel Co., New York.

12:30 p.m.—LUNCHEON.
Speaker, R. E. Kennedy, technical secretary, American Foundrymen's association.

2:00 p.m.—LABORATORY DEMONSTRATIONS.
Materials testing; microscopic examination of cast metals; high temperature testing of foundry sands; crystallization demonstration, and photo-elastic demonstration.



Put These Three Features to Work for You

THERE are three important features of Norton Resinoid Snagging Wheels that are enabling them to definitely cut cleaning room costs for many foundries.

1. *Alundum Abrasive* — special Norton crushing and sizing methods give strong, tough, ruggedly shaped grains to meet the severe service of snagging work.
2. *Resinoid bond* — special formulae developed by the Norton laboratories for snagging work.
3. *Controlled Structure* — a Norton manufacturing process makes it possible to regulate grain spacing to fit the requirements of each individual snagging job.

These three features can cut grinding costs for *you* just as they are for others.

NORTON COMPANY, WORCESTER, MASS.

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NORTON ABRASIVES

Fig. 7—Partial view of mold for the water box casting shown in Fig. 10

Cement Used As Binder

(*Continued from page* 26)

constantly is augmented and maintained in proper amount by the constant influx of facing sand.

In addition to its own particular line of hammers, anvils and accessory equipment, the company makes castings for several outside interests, including a prominent manufacturer of machine tools. Prerequisites of all these castings include a clean, smooth surface, freedom from fins, shrinks or blowholes, swells, and close conformity to dimensions laid down in the blueprints. It is claimed that castings made in cement bonded sand molds meet these conditions. The reason, appreciated by the man with foundry experience, and apparent even to the lay man, is that the mold is rigid and strong enough to resist weight and pressure of the molten metal. The silica sand facing is more refractory than ordinary molding sand and therefore does not fuse. In this connection it is interesting to note that the sea coal in the facing improves the peeling quality of the sand. One might digress here to theorize on this somewhat controversial subject, but it is not pertinent to the present discussion. As an additional factor in securing clean, smooth castings, the face of the mold is covered with wet blacking as in ordinary dry sand molding practice.

However, the outstanding feature of the process, the feature that differentiates this type of mold from any other, is that no heat is applied to dry the molds either in an oven or by fires placed directly in the molds. The molds simply are air dried. In from 24 to 48 hours after the molds are finished, the walls are as hard, dry and rigid as any piece of concrete construction. Incidentally, since there is no combustible material in the mixture, no gas is generated when the mold is filled with molten metal.

Molding Methods Differ

On certain patterns the molding method is similar to that usually employed in any foundry. On others, the method differs to some extent. Practically no cope is rammed on top of a drag. Where a symmetrical pattern is split through the center, each half is molded independently of the other and rolled over and allowed to dry. Later the drag remains in the same position but the cope is rolled back and placed on top of the drag. Where the cope is flat, it is laid on its back and rammed full of sand. The gate stick or sticks, also any riser blocks necessary are placed in position and a thickness of facing sand is rammed over the other sand. This facing is struck off flat with a straightedge riding on the flanges of the cope flask.

In many instances where the pattern normally would project in regular or irregular contour into the cope face, the necessary shape is imparted to the sand by one or more templets and sweeps. In other instances the mold is covered with one or if necessary a number of slabs reinforced with arbors and

(*Concluded on page* 83)

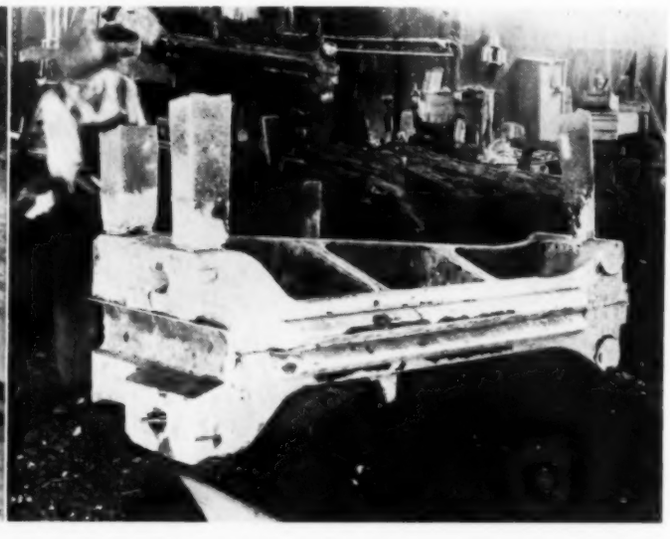


Fig. 8 (Left)—Mold for airplane fuselage gated around lower edge at far end. Fig. 9 (Right)—Frame casting for board hammer. Large feeding risers are required on special alloy iron

ADVERTISING PAGES REMOVED

(*Concluded from page* 80)

constructed after the manner employed in making dry sand cores. This method also is adapted in some instances in the construction of large molds where a number of sections first are made and dried and then assembled in a flask or pit to form the complete mold as shown in Fig. 1. In each instance the frame or corebox is lined with the cement bonded sand and the remainder of the space not occupied by the arbor is filled with the rubble or loosely broken material reclaimed from former molds.

Cores Are Air Dried

With the exception of certain small cores on which experiments are going forward, all cores, large and small are made from the cement bonded sand mixture. A section of the coremaking department is shown in Fig. 3. They are turned out on machined cast iron plates where they become dry and hard in a short time. In the green state the bond furnished by the cement, plus the stiff interior made up of rough material enables the cores to stand up without any wilting or sagging. Hooks for handling the cores are inserted as in ordinary practice, but the number of rods or other artificial reinforcement is reduced to a considerable extent. Later this feature reduces the cost of cleaning the castings.

The Chambersburg Engineering Co., blazed its own trail in the development of a special metal for hammers and anvils. As with many other developments the present proprietary metal resulted from metallurgical research undertaken during the recent depression with a view of increasing the production capacity and accuracy, and reduce the maintenance cost of the forging hammer. The aim was a metal for anvils and frames combining the mass and vibration resisting properties of gray iron with the strength and wear resisting properties of steel. The metal under a trade name also is used in other castings where its special properties find application.

Chief characteristics of this metal are a fine homogeneous grain structure, tensile strength of from 40,000 to 50,000 pounds per square inch and brinell hardness which can be controlled in the furnace to suit the purpose for which the casting is intended. Carbon content which ranges between 2.95 and 3.00 per cent can be controlled within 0.05 per cent plus or minus. As a result of the fine graphite-free grain structure the metal may be machined to a clean, smooth surface.

Oil Fired Air Furnaces

Metal is melted in a battery of three oil fired air furnaces designed and built by the company. The oil is preheated and the flame enters the furnace at one end. The furnaces are located outside one wall of the foundry with the inner ends and tapping spouts on the inside. The bung tops are removable for convenience in charging with a crane. This applies particularly to large pieces of scrap, anvils, frames and similar miscellaneous forms of scrap which are not acceptable to the majority of foundries. Each furnace has a capacity of 40,000 to 50,000 pounds, sufficient when combined and if necessary, to pour a 75-ton casting.

Many of the anvil blocks and other castings purchased as scrap are too large for insertion in the furnace. Also they are too massive to be broken in the usual manner under a drop ball. These pieces are taken to the machine shop and placed either in a lathe or on a large planer and given one or more deep cuts. They then are broken by driving wedges in the cuts.

The usual furnace charge is made up of 70 per cent scrap and 30 per cent malleable pig iron with low sulphur and phosphorus content and carbon under 3.00 per cent. Alloy additions to the charge include molybdenum 0.30 to 0.50 per cent, chromium 0.35 per cent and nickel 0.60 to 1.50 per cent. The nickel is omitted from the charges for anvil castings. Maximum tensile strength of this iron is 60,000 pounds per square inch.

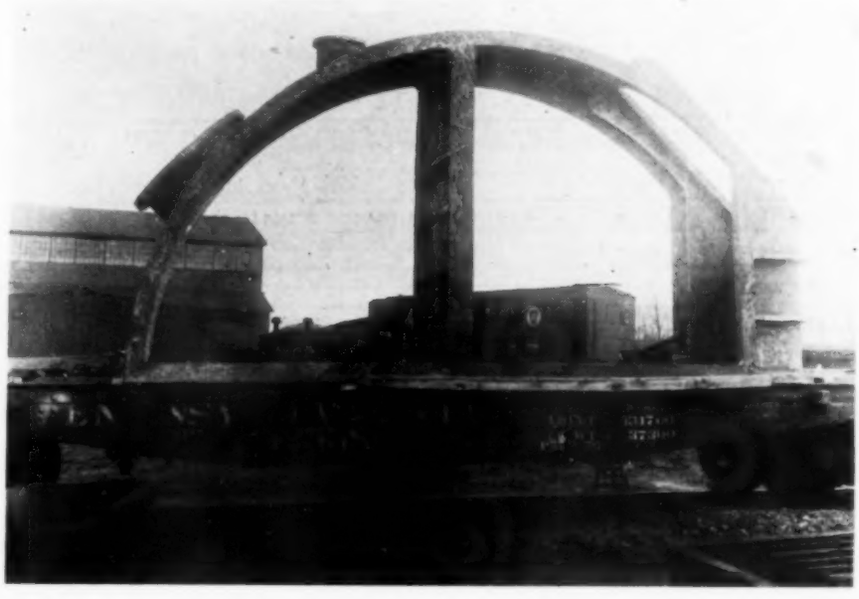


Fig. 10—Water box casting accurate to shape and dimensions. Inside and outside of the mold in cement bonded sand

Discuss Porcelain Enameling

During the week of Oct. 11 the Porcelain Enamel institute, Chicago, held its seventh annual meeting, and its second forum. The annual meeting was held at the Congress hotel, Chicago, on Oct. 11 and 12, and the officers elected for the coming year include: F. E. Hodek Jr., General Porcelain Enameling & Mfg. Co., Chicago, president; H. D. Chase, Chicago Vitreous Enamel Product Co., Chicago, vice president in charge of advertising and promotion; Richard H. Turk, Porcelain Enamel & Mfg. Co., Baltimore, vice president in charge of research; William Hogenson, Chicago Vitreous Enamel Product Co., Chicago, treasurer, and George P. MacKnight, managing director and secretary.

The second Porcelain Enamel institute forum was held at Ohio State university, Columbus, O., on Oct. 13, 14 and 15. Over 230 attended the several sessions which dealt with a variety of subjects. One session of the forum was devoted to cast iron under the direction of W. N. Harrison, National Bureau of Standards, Washington, at which the following papers were presented: "Effect of Modern Blast Furnace Practice on the Manufacture of Pig Iron," by William Curran, Republic Steel Corp.; "Molding Sand and Molding Practice," by R. B. Schaal, Ferro Enamel Corp., Cleveland; "Abrasive Cleaning Practice and Equipment," by R. E. Donnelly, Pangborn Corp.; and "Discussion of Cast Iron Bulletin," by G. H. Spencer-Strong, Porcelain Enamel & Mfg. Co.

C. F. Pease Co. has moved its office and plant to 2601 West Irving Park road, Chicago.

FLOOR NO. 38	MOLDER Jones	OPERATION Air Sq.	PAY ENDING 3-20-36
CUSTOMER Duplex	CUSTOMER	CUSTOMER	CUSTOMER
PATT. NO B-39	PATT. NO B-40	PATT. NO	PATT. NO.
PCS. TO MAKE 10,000	PCS. TO MAKE 5000	PCS. TO MAKE	PCS. TO MAKE
PCS. IN MOLD 4	PCS. IN MOLD 6	PCS. IN MOLD	PCS. IN MOLD
PRICE PER 100 MOLDS $6.00	PRICE PER 100 MOLDS $7.00	PRICE PER 100 MOLDS	PRICE PER 100 MOLDS
BALANCE TO MAKE 10,000	BALANCE TO MAKE 5000	BALANCE TO MAKE	BALANCE TO MAKE
REMARKS:	REMARKS:	REMARKS:	REMARKS:
PAY MOLDER 712 x $6.00	PAY MOLDER 102 x $7.00	PAY MOLDER	PAY MOLDER
TOTAL PAY $42.72	TOTAL PAY $7.14	TOTAL PAY	TOTAL PAY

DAY	DAILY COUNT	NIGHTLY COUNT	INSPECTORS COUNT	BAD CASTINGS
MON.	120	115	115	4
TUE.	143	145	145	6
WED.	150	155	152	7
THUR	160	155	154	2
FRI.	165	170	165	–
SAT.	X	X	X	–
SUN.			X	
TOTAL		740	731	19
PAY			712	

DAY	DAILY COUNT	NIGHTLY COUNT	INSPECTORS COUNT	BAD CASTINGS
MON.	X			
TUE.	X			
WED.	X			
THUR.	X			
FRI.	X			
SAT.	100	102	102	0
SUN.				
TOTAL			102	0
PAY			102	

DAY	DAILY COUNT	NIGHTLY COUNT	INSPECTORS COUNT	BAD CASTINGS
MON.				
TUE				
WED				
THUR				
FRI.				
SAT.				
SUN.				
TOTAL				
PAY				

Total Earned $ 49.86

DAY	DAILY COUNT	NIGHTLY COUNT	INSPECTORS COUNT	BAD CASTINGS
MON.				
TUE				
WED				
THUR				
FRI				
SAT				
SUN.				
TOTAL				
PAY				

Fig. 13—This card shows the complete record of the molder's production for one week

Keep Track of Costs

(*Continued from page* 28)

weekly record of molds produced and scrap losses. Copies of this order go to the pattern vault, core room, foundry, cleaning and shipping departments, each order in a different color.

When the order reaches the pattern vault, the pattern is located and taken out to be placed in production. If it is a new pattern a record is made on a pattern record card and a location found for it in the pattern vault. After production is completed the pattern is returned to the same location. Coreboxes are sent to the core department with the original order. Cores are started and a start sheet of the pattern is made out by the core room foreman and sent to the foundry foreman to inform him when the cores will be available.

When the cores are made and the job started, a start sheet Fig. 11 is made out by the foundry foreman and copies sent to the office, superintendent, grinding room, shipping room and night foreman. The start sheet gives the cleaning and grinding departments opportunity to prepare for the castings as they come from the foundry. It also gives the production department an opportunity to give the customer service on rush jobs. The stop sheet Fig. 10 keeps the production department cognizant of production and also prevents the over-running of orders to any extent.

Fig. 13 shows a complete record of the molder's production for one week, total molds produced each day, total daily count compared with night superintendent count, in spector's record of defective castings inserted in the book in red the following day. Just before wind time, or at a designated hour each day the foundry clerk passes through the foundry and gets a count from each molder of the number of molds he has produced, or an estimate of the number of molds he will have by the end of the day. The clerk also presents a slip, Fig. 12 to each molder showing the record for the previous day.

Detail of Weekly Count

The daily count is recorded in the first column under the proper pattern number shown in the heading Fig. 13. For example consider pattern No. B-39. On Monday molder Jones produced 115 molds, but estimated that he would put up 120. The clerk records 120 molds in the first column. The night man counts only 115. This count is set down in the second column to the right of 120. The next count is made by the inspector the following day. He finds that 115 molds were made but 4 were defective and are to be charged to the molder. He sets down 115 in the next column under inspector's count and 4 in the last column in red under bad castings.

This record is kept for a week and shows a weekly night count of 740 molds, an inspector's count of 731 and scrap castings 19. There are four castings in a mold. Four molds are deducted from the total leaving a total of 712 good molds for which the molder is paid $6.00 per hundred, or $42.72 for his production from Monday to Friday inclusive. On Saturday the molder worked on pattern No. B-40 and estimated to the clerk that he would put up 100 molds. The night count showed 102. The inspector's count showed that all the castings were good. Molder Jones is paid at the rate of $7.00 per hundred, or a total of $7.14. The lower right corner shows the total amount earned from Monday to Saturday inclusive is $49.86.

Report Shows Record

After the week's work is finished the daily production book is sent to the office and the amounts are extended by the pay roll clerk who makes out each man's weekly pay. The sheets are made up so that as many as needed can be added from day to day depending on the number of molders in the shop on any given day.

In addition to the mold count by the night superintendent, his report shows an itemized record of the work accomplished, design of flask equipment, whether the molds were made on the floor, machines

(*Concluded on page* 96)

PRODUCTION ORDER

PATTERN NO. B-39
NO. IN MOLD 4
HOW MADE. Air Squeezer

CUSTOMER Duplex
DATE 3-19-36
FLASK - Alum. 14 x 18 x 4" Cope, 3" Drag } snap

QUANTITY	TO FOUNDRY	START	Date Wanted	STOP
10,000	3-20-36	3-21	3-22	

Mold Price $6.00 per 100
Core Price 75 cts " "
No. cores in mold. Four
Patterns in Mold. Four
Patt. Design. Match Plate
How Cleaned. Sand Blast

Remarks.
Last order showed shrinkage at boss Advised pouring a little colder.

Difficulties last order.
Shrink at boss.
Last order made on Floor Number 38.

Weight to hold. 4 lbs each.
" Mold 24 " G&S
Size of flask 14 x 18 4/3

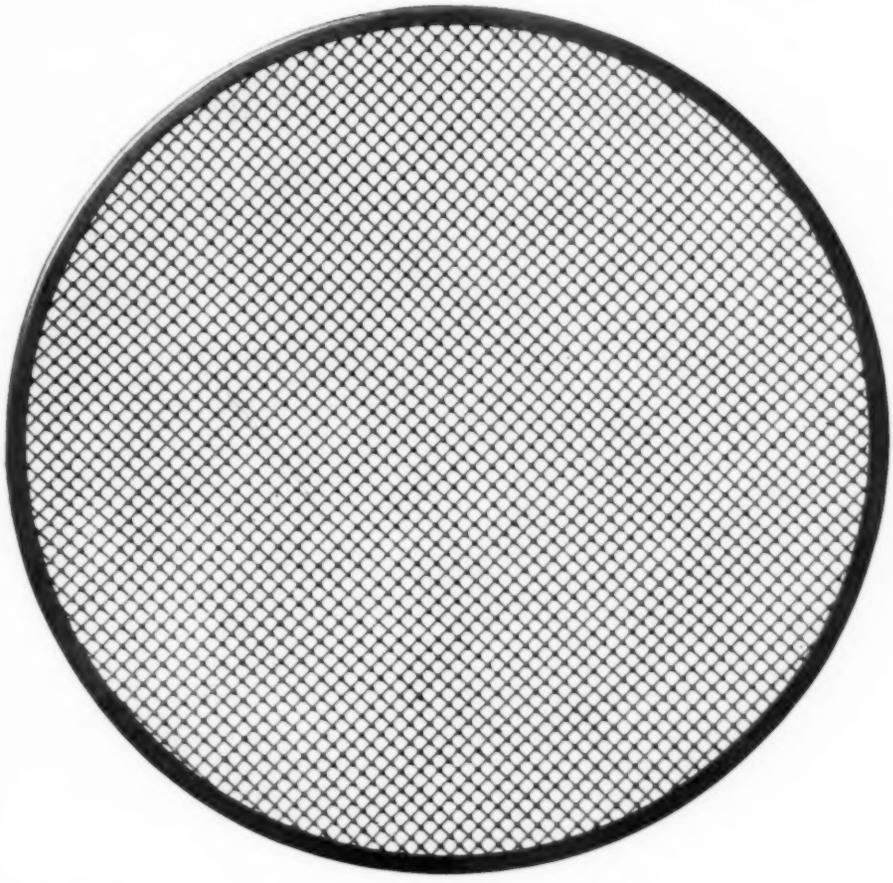
Copies of above order to go to
1. Pattern Vault.
2. Core room.
3. Foundry.
Cleaning and grinding dept.
4 Shipping Dept.

G. Gates
S. Sprue

Fig. 14—Order forms from the office are issued to the foundry foreman, and give itemized information

Foundry Supplies Mfg. Co.

NEW *QUICK CHANGE* SIEVES



★ *Clear Sifting Area—20 Inch Diameter*

For Use with the New and Improved UNIVERSAL "*Free Wheeling*" RIDDLE

The Finest Foundry Sieve Made

Instantly, Easily Interchangeable
Much Larger Sifting Capacity

Built with a Smooth, One-Piece, All-Steel Rim
No Rough Edges to tear workers' hands
No Adjusting in changing from one mesh sieve to another—all sieves one size

No Waste Space, No Storage Problem
"You can stack them just like playing cards"

Sold by Leading Foundry Supply Houses

Ten Days Free Trial

Nos. 2 to 6 Mesh **$1.35 Each** f. o. b. Chicago

FOUNDRY SUPPLIES MANUFACTURING CO.

2221 Orchard St., Chicago, Ill. Tel. Diversey 5453

Control Basic Practice

(*Continued from page* 30)

cut down at the same time. This condition is maintained until the heat is tapped. Reduction of draft, fuel oils and steam at the time of making the final additions is recommended, because this condition cuts down the amount of oxidation of the metal and consequently less loss of manganese and carbon, and of chromium when used.

Fuel oil of a gravity of 5 to 12 degrees Baume is used. The temperature of fuel oil, when it enters the furnace is 170 to 190 degrees Fahr. A preheater is used for the oil before it enters the burner. The amount of fuel oil being burned per hour is indicated and recorded. The amount of fuel oil necessary cannot be stated definitely, but can be determined by experience for each furnace, and after being determined, is followed closely; 120 to 130 gallons per hour after charging is the general rate employed.

Fuel Oil Cut Down

The fuel oil rate of flow is reduced when the heat is melted. On heats which melt very hot, the consumption of fuel oil may be cut down as low as 80 to 90 gallons per hour when the final additions are made. At the time final additions are made, the fuel oil should be cut down as low as possible.

Use of superheated steam for atomizing the fuel oil is in order to be assured of dry steam. The temperature of the superheated steam at the regulator should be 600 to 700 degrees Fahr. Pressure should be 55 to 60 pounds at the regulator. This is maintained until the heat is melted. When the heat is melted, the steam pressure is adjusted to the conditions in the furnace. When the final additions are made, the steam pressure is reduced and a soft rolling flame is held until the heat is tapped.

The furnace charge should contain sufficient lime to remove the impurities in the metal and furnish protection to the metal from an oxidizing flame. Whenever it is necessary to use fluorspar to condition the slag, the amount used should be held to a minimum.

During charging and until the lime starts to come up, the furnace is run with a full flame, predetermined settings being maintained by the instruments. The temperature of the bath at the time the charge is melted should be high enough to cut down the fuel oil, air and steam gradually. By this practice some manganese and chromium reverts to the steel from the slag.

As soon as the heat is melted and the lime is up, which is indicated by the absence of localized violent boiling action in the bath, a spoon test of the metal is taken, the melter judging the carbon content by the size of the crystals in the fracture. Upon the carbon content the melter bases his judgment as to the amount of iron ore to add, and also to the time it is to be used. The heat should be at a fairly high temperature; the slag should be in a mushy condition.

Slag Becomes Creamy

After the iron ore addition, the bath will break into a brisk boiling action, which should gradually slow down to a uniform gentle boiling action over its entire surface, the boiling action becoming less intense and the carbon drop less rapid as the bath approaches a carbon content of 0.25 per cent. During this time the amount of fuel, air and draft is diminished gradually but a plus pressure is maintained. The slag should be assuming a creamy condition. Iron ore is not used until the slag is in a mushy condition.

Tests are taken by first slagging the spoon thoroughly, then thrusting it down into the steel, withdrawing it and pouring the steel into a test mold. The test should be cooled slowly and all tests given approximately the same treatment, or variations in the results of the analysis may be expected when the laboratory uses the color method of analysis.

On the first preliminary test the chemical laboratory determines the carbon, manganaese, sulphur, and on chrome heats, chromium. On all subsequent tests the chemical laboratory determines the carbon and manganese. Other tests are taken as the refinement of the metal proceeds.

Furnace additions to other class heats include: 15 per cent ferrosilicon which is added to the bath 10 minutes before tapping. The charge of 80 per cent ferromanganese usually is divided. Ground 80 per cent ferromanganese is added through a chute over the furnace runner, usually 100 pounds per heat when this quantity is available; the balance of the ferromanganese should be added to the bath 3 minutes before tapping. Where no fines are available, it is satisfactory to use lump 80 per cent ferromanganese through the furnace.

The quantity charged should be adjusted, the amount used depending on the residual manganese in the bath as shown by the preliminary tests. Ferromanganese charged in the furnace should be moistened to assist it in passing through the slag, and if any lumps should hang in the slag, it is satisfactory to push the lumps through the slag with a rod. Added in the chute the ferromanganese should be broken into pieces that will go through a ½-inch screen.

All of the 50 per cent ferrosilicon is added through a chute over the furnace runner. The material should be broken into pieces that will pass through a ½-inch screen.

When the final additions are made, the draft is cut down. The amount of fuel oil burned and steam used for atomizing is reduced as much as possible, and this condition is maintained until the heat is tapped.

In tapping the heat the material used to close the tap hole is removed from the outside, leaving only a few inches of material on the inside. The tap hole and the runner are cleaned thoroughly before proceeding. A tapping rod is inserted through the observation hole in the center door of the furnace, slagged, and after locating the tapping hole, the rod is thrust endwise against the material left in the tap hole until the rod pushes through and allows the heat to run out of the tap hole into the ladle.

Chute Is Opened

When the metal in the ladle is approximately 1 foot deep, the bottom of the chute over the runner is opened, allowing the material in the chute to run into the stream of metal as it runs from the furnace into the ladle. The chemist's report of the carbon and the manganese in the final preliminary test usually is received too late to make adjustments of the addition charged into the furnace. Therefore, the adjustments required are made in the materials charged in the chute over the furnace runner.

Furnace bottoms should be maintained in good condition. After a heat is tapped, the furnace bottom should be free from pools of slag or steel. When the bottom becomes uneven, due to lime adhering to it or due to portions of the bottom materials becoming loosened by the action of the bath, the pools should be splashed or rabbled out so that the slag or steel will drain out at the tap hole.

When a large or deep hole occurs in the bottom, care is taken to rabble it out clean, and to dry it up with bottom materials. After drying, the hole is filled with bottom material, each addition being sintered until the hole is built up to the bottom level.

After all the pools have been rubbed out and filled in with bottom material where this is necessary, slag is shoveled in front of the tap

(*Concluded on page* 90)

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Gating Nonferrous Castings

(*Continued from page* 31)

the mold.

Obviously, edges of gates should be rounded carefully so that there may be no sharp edges to wash away. Where sharp sand edges meet at the junction between cope and drag, the edges should be removed carefully to avoid any possibility of crushing the sharp edge upon closing the mold and thereby producing loose sand which may be washed into the mold cavity with resulting defective casting.

To produce a better finish on red brass castings it is common practice to surface the mold with a floured carbon or lamp black. This material should be applied sparingly to the gates and mold cavities. Properly applied, the coating does add to the superior appearance of the castings. Frequently it prevents burning-in of the metal, a feature which sometimes troubles foundrymen engaged in casting these alloys.

Gates on Phosphor Bronze

With the phosphor bronzes, the bell metals (Standard S. A. E. 65), copper 89 per cent, tin 11 per cent, and other similar alloys containing little other elements than copper, tin and phosphorus, the gating is similar to that of red brass except that due to the increased fluidity of the metal the size of the gates need not be as large. There is a very definite necessity for risers, and risers must be of ample size to insure proper feeding.

Where there is some argument as to whether the small shrinkage in red brasses require feeding or not, there is no argument over the absolute necessity of feeding phosphor bronze castings. A phosphor bronze casting without proper feeding is worthless. Examination of the fracture of an unfed casting will show that the grain is open and the structure loose. If the casting is subjected to a leak test, it is very likely to fail.

If the service is resistance to wear, it will be found far less serviceable than if it were properly fed. In these alloys part of the alloy known as the matrix solidifies first. Later the remainder of the alloy which has been fluid, while the matrix is setting, finally sets itself and the casting as a whole is set.

During this process that part of the alloy to set last is very fluid until it does set and may be forced out by shrinkage forces or gas pressure to form what has been known as liquation. Frequently it appears on top of the riser in globules of liquid metal forced out by gas pressure during the process of solidification.

This phase is described here because if the casting has been properly fed, the reverse condition exists. Instead of having liquation occur in the form of globules squirted up to the top of the riser or out of the side of the casting or riser, it should be forced into the casting as the casting sets so as to insure the perfect soundness of the casting when completed.

This, of course, refers to metal that has been properly melted. Where the metal has been improperly melted and been allowed to absorb gases, ejection of the gases as the metal solidifies will cause this liquation, or what commonly is known as tin sweat, whether the risers are the correct size, or whether there are no risers at all.

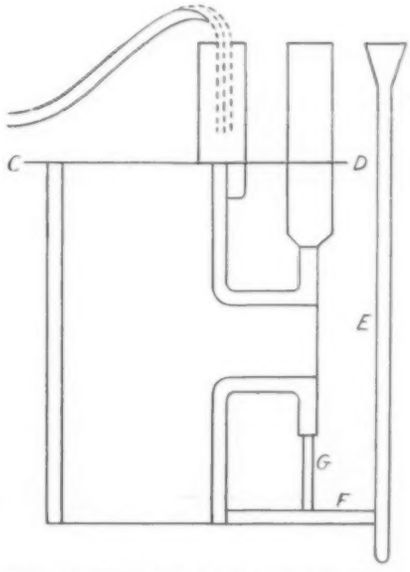

Fig. 10—Metal from the sprue E enters the casting at the bottom through gates F and G. Pouring ceases when the metal arrives at line CD. Additional fresh metal then is poured into the riser

Wherever possible, the best gating practice is to gate into the riser and then from the riser to the casting. If several risers are necessary for a certain type of casting, it may be desirable to gate into each of these risers and from each of them to the casting. This will insure hotter metal in the riser where it will solidify after the casting has set. During setting of the casting, liquid metal will be available in the riser to supply demands of the setting casting.

Phosphor bronzes are very fluid in their molten state. No seams or films are formed when several streams unite. Therefore, metal may enter through a number of gates without any danger of forming seams unless the pouring temperature of the alloy is too low. Quiet flow of metal into the mold is desirable. A gushing spraying effect may produce defects that are hard to explain.

Agitation of the phosphor bronzes does not produce the slags that are produced in the yellow brasses and some of the other bronzes, but it does reduce the phosphor content. If a certain phosphor content is demanded, it is certain to be impaired by such agitation. The best practice is to have the sprue of the proper size to control the rate of flow.

When the sprue is kept full, the metal will flow quietly into each and all of the mold cavities with sufficient speed to fill the mold without forming cold shuts, and without causing the metal to be chilled too much at its first entrance into the mold. Later this metal must be warmed up by the remainder of the metal entering the mold to insure the complete soundness of the entire casting.

Forced To Blind End

The runner should be of proper size, free from all sharp edges and arranged so that the first metal to come down is forced into the blind end of the runner indicated at *B* in Fig. 9 where it will trap any sand or other foreign material carried down by the force of an entering stream of molten metal. When this runner later is filled by the continued pouring, the metal should run through the necessary gates of proper size and well smoothed surface of the casting cavities. If there are risers, then through the riser to the casting. These risers at the bottom should be well cupped to offer no resistance to a quiet flow of metal into the mold.

Where the heavy sections of the castings are located so that risers cannot be reached by gates except through the castings, obviously the metal having passed through the casting and then into the riser, the riser will be of lower temperature than the casting. The riser will set before the casting does and in shrinkage will demand metal from the casting unless the condition is corrected.

To correct this condition, the temperature of the metal in the riser should be raised by the addition of fresh hot metal directly into the riser after the casting has been poured as in Fig. 10. Therefore, provision, should be made for supplying hot metal to the risers so that these risers definitely remain molten until sometime after the casting has set.

Phosphor bronzes are very fluid. They tend to seek out opportunities to run anywhere in the mold. Dan-

ger of run-outs in the mold are accentuated by this condition. An extremely open sand offers an opportunity for the metal to run into the sand and make a dirty, drossy casting, or at any rate a dirty drossy sprue and gate, which later must be cleaned before it can be added to a future melt.

Poured at relatively high temperature, as phosphor bronzes must be when the casting is extremely thin, they will eat into the sand. Consequently the mold and gates, runners and risers must have their surface properly taken care of to prevent this eating into the sand. To do this a good blacking should be applied to the surface of the molds, gates and runners. Where possible, the coating should be well rubbed in particularly where large masses of metal are located, as in heavy castings.

Smooth, well finished gates and runners may appear to be an expensive luxury; but it is a precaution well worth its expense and one of the many steps that lead to a better class of product in the final production of castings.

Where the gates must pass through cores, the proper sand mixture for these cores is very important. Phosphor bronzes tend to burn into the sand and to burn the bonding material in the core, thus releasing sand which later may be washed into the mold to produce defective castings.

A minimum amount of bond should be used in the core sand mixture. After the cores are dried, they should be very carefully coated with the proper plumbago or graphite facing. Where pasting is necessary the absolute minimum of paste should be applied since paste presents an opportunity for metal to burn in at the joint, possibly erode sand from that joint and carry it into the casting.

This is the second of a series of articles relating to various phases of nonferrous foundry operations.

Invisible Shrinkage

(*Concluded from page* 27)

reached, we have a mass of these spines interpenetrating the liquid which is, as it were, *land locked* between them. Although there are perhaps passages from one puddle of liquid to the next these are so fine that the liquid in the upper portion of the casting can not flow down and feed the lower part but some unfilled spaces accompany every dendritic crystallite.

The resulting voids are then so small and so widely distributed that they escape radiographic detection and unless badly discolored may not even be visible in a fracture although it seems extremely likely that their total amount is still what might be calculated. A knowledge of this widely distributed form of shrinkage voids has many implications to the foundrymen.

First it explains such phenomena as the absence of voids in some castings, especially small ones in which freezing is so rapid that much entrapping of the liquid eutectic takes place. It suggests also an explanation of why castings produce a deep settle in the feeder and others do not. A relation to pouring temperature is at once indicated.

Castings intended for pressure service may look shrink free but still sweat as the result of the condition described. On the other hand, visually sound castings may be all that is required and complete, fine dispersion of shrinkage be desirable.

The determination of shrinkage tendency by examining the fractures of K or X shaped castings where the arms cross, has a relation to the condition we are discussing. It measures the tendency to a visible and localized shrink under the particular foundry conditions with at least a fair degree of satisfaction but, since shrinkage may be invisibly dispersed, does not measure the amount of shrinkage to be expected of the iron.

Iron low in total carbon will freeze with final separation of relatively little liquid eutectic and iron of high carbon with relatively much. It seems plausible therefore that in the latter case the liquid, being less interfered with by dendritic branches, can flow in and fill up voids better than in the former. On the other hand, the *land locking* phenomenon being more pronounced, the existing voids may be more widely dispersed. The two considerations may account for some of the divergence of opinion as to the effect of carbon on shrinkage and the first of the two explain the preference of manufacturers of pipe fittings for relatively high carbon cupola iron.

(1) See *Shrinkage*, H. A. Schwartz, THE FOUNDRY, November, 1935, p. 27; December, 1935, p. 46; January, 1936, p. 50; February, 1936, p. 50; March, 1936, p. 54; April, 1936, p. 60; June, 1936, p. 50; July, 1936, p. 46; August, 1936, p. 46.

(2) See also "Shrinkage of White Cast Iron," *Transactions*, American Foundrymen's association, vol. XXXVII, p. 205, 1929.

Bureau of mines, department of the interior, Washington, recently has published technical paper No. 576 which is entitled "Bibliography of United States Bureau of Mines Investigations on Coal and Its Products—1910-35," by A. C. Fieldmer, Alden H. Emery, and M. W. Von Bernewitz. Copies of the paper may be obtained from the superintendent of documents, Washington, for 15 cents.

Control Basic Open Hearth Practice

(*Concluded from page* 86)

hole to stop the flow of slag into it. The tapping hole then is filled in from the outside with bottom material, which should be rammed in tight.

The slag line along the back wall and ends is made up by throwing bottom material on it with a shovel. The front wall is made up by placing bottom material on it with a spoon. The contour of the bottom along the back wall and the opening into the tap hole is maintained, so that when the tap hole is opened the slag will not run out until the steel is practically all out of the furnace.

At the end of each week, when the last heat has been tapped, the furnace is run hot so as to slag the bottom, and two or more slag heats run off, depending on the bottom condition. The bottom is not made up again until within one hour of charging. The diameter of the tapping hole is maintained as close as possible to 6 inches. When repairs are necessary, a 6-inch pipe is placed in the hole and the space around it filled in with a mixture of gannister or chrome, and cement. The furnace bottom always provides for a bath depth of 22 inches, the measurement taken at the center of the furnace.

By the use of a uniform charge from heat to heat and by the control of refining operations, it has been possible to produce consistently the highest grade of steel of required compositions, physical properties, and other qualities. Pig iron, scrap, slag forming materials, and fuel are analyzed and each charge made in a standard manner as to quantity and composition.

Rate of fuel consumption, draft control and other similar factors necessary for maintaining combustion conditions needed at different stages in the heat, are known definitely to the operator and are recorded for the benefit of the open hearth superintendent in seeing that the outlined practices mentioned are followed.

The result is that heats melt uniformly, show identical melting properties from heat to heat and thus provide a means for consistent results insofar as the finished steel is concerned.

Another factor is the tapping time of heats which may be accurately forecast and production requirements met; thus, the pouring schedule is arranged so there will be a minimum handling of flasks and equipment in the molding department.

· SERVICE ·

Oven Assembling in Our Plant

THIS typical scene, showing our factory assembling of several large ovens, is but one evidence of our service to you.

For several decades, we have been building Foundry and other Industrial Ovens. Some of the few early ovens we built are still in operation. While good for their day, we now would call them crude, though each one reflected an effort to save heat and give quicker and more even bakes, at reasonable initial oven cost.

Following through the years, our present insulated steel panel ovens, with their modern heating, venting, recirculating, and handling methods, were the final logical answer.

These developments went hand in hand with improved service to you, including an experienced engineering force and well qualified representatives covering all industrial sections.

To give you lowest core costs, our construction is such that we can economically build an oven which will exactly fit your conditions, of floor space, output, handling and heating methods, etc.

Ovens now being built will go from coast to coast. They include capacity ranges from 100 lb. to over 16,000 lb. of cores hourly; types, from drawer pull to lift rack and continuous conveyor, having various heating methods.

Some of these ovens will be erected and started by us; others, by our Customers, with the aid of marked, detailed prints.

Our service in seeing that your oven serves you best, starts when we receive your inquiry and continues indefinitely. Reflecting this, one of our Customer's Engineer, who himself is a master of details, and who has placed several large orders with our Company, stated: "We like to deal with you; even the smallest detail does not escape the attention of your Engineers."

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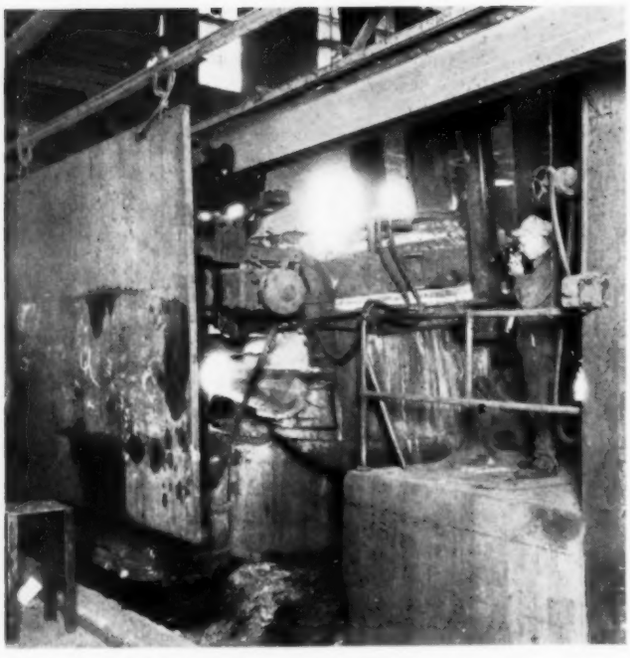

Fig. 18—Temperature readings are taken at definite periods so as to enable close control

Anneals Castings Rapidly

(*Continued from page* 34)

tubes are below the work.

The tubes employed in the furnace are the hairpin type, that is to say they are shaped like the letter U, with both openings the same side of the furnace. One opening is equipped with a combination premix and diffusion type gas burner to provide a long radiant flame while the other end is fitted with an aspirating type exhauster or eductor which creates a negative pressure inside the tube. The latter prevents escape of the gases of combustion inside the furnace in case of any failure in the tube.

Tubes in the heating-up and holding zones are fired so that a temperature of 1750 degrees Fahr. is maintained, but in the rapid cooling zone immediately following the holding zone, the temperature is reduced from 1750 to 1400 degrees Fahr. in a travel of approximately 6 feet and that is accomplished by blowing air under pressure through the tubes in that section of the furnace. The tubes in the slow cooling zone are fired so that the temperature is reduced at the rate of 9 degrees per hour from 1400 to 1310 degrees Fahr., and then rapidly from that temperature to room temperature when they are discharged from the furnace.

The various stages in the annealing cycle occupy different periods of time which are as follows: Heating-up or bringing to maximum temperature interval, 8½ hours; holding at maximum temperatures interval, 10 hours; rapid cooling period, 1 hour and 45 minutes, and slow cooling 10 hours and 25 minutes. Castings are loaded into the furnace on individual trays, 2 x 3 feet, and 18 inches high which ride on roller rails. The furnace is arranged to take four rows of trays, and each has its own hydraulic pusher mechanism. Each row between the inner doors of the vestibules contains 46 trays. The tray are loaded with about 750 pounds of castings, and a push of trays is made every 40 minutes so that the daily production of the furnace is approximately 55 tons.

Use of a controlled atmosphere within the furnace also has much to do with the reduction of the time in the annealing cycle. In addition that atmosphere eliminates scaling of the castings. The atmosphere in the furnace contains about 12.5 per cent CO, and 6.5 per cent CO_2 which is produced in the furnace by the reaction of the iron and a gas manufactured by burning natural gas in a special machine with controlled combustion so that the final product contains no oxygen and has a composition of 10.5 per cent CO_2 and 1½ per cent CO. Approximately 3000 cubic feet of that gas is admitted to the furnace per hour.

Operation of the furnace except for pushing a button to unlock the outer charge vestibule door, and pushing the trays in, is entirely automatic. Control of the cycle is obtained through interlocking electrical relays and limit switches. In operation the following procedure occurs at the beginning of a new cycle. The inner and outer doors of the charge and discharge vestibules are closed and locked. The discharge vestibule is being purged with a gas containing about 1.5 per cent CO (same as that put in furnace proper) and that is indicated by a red light at the charge end.

The operator then pushes a button which unlocks the outer door of the charge vestibule, raises the door, and pushes in a loaded tray on each of the four rows. The door is then lowered, and that automatically opens the purging valve. The purging is controlled by a timer which operates a green light at the end of the proper interval. Then the operator presses a button which starts the "push." That action shuts off the purging valves in both vestibules, turns out the green light, and raises both inner doors of the vestibules. As the doors reach the top of their flight, the pusher mechanism goes into action and shoves the trays into the furnace proper. When the trays are clear of the inner discharge door limit switches operate which return the pushers to their original position, and lower the inner doors of both vestibules. When that is accomplished the outer door of the discharge vestibule opens and the trays are propelled out by power rollers onto the receiving table. As the trays clear the door they pass over limit switches which close and lock the outer discharge vestibule door and open the purging valve which turns on the red light at the charge end indicating that everything is clear for another cycle.

Inspected and Sorted

After annealing the castings are inspected and sorted. Many castings made at the Saginaw Malleable Iron division contain a small test lug which is broken off during inspection and if the fracture shows shady, the casting is discarded. Following those operations, the castings are forwarded to the trimming department, shown in Fig. 17, where the gate stubs are removed on sprue cutting machines. Then the castings are ground at those points to give a smooth surface. The next operation is tumbling or a combination of blasting and tumbling after which the castings are subjected to a press straightening operation, again inspected, and stored.

In addition to its work on regular malleable cast iron, the technical staff of the Saginaw Malleable Iron division has spent considerable time on the investigation of pearlitic malleable iron as related to production and applications. Numerous tests under regular operating conditions indicate that pearlitic malleable cast iron gives excellent results for many automotive parts.

At the present time only one type of casting in pearlitic malleable cast iron is being produced on a commercial basis in the plant, and that is the rocker arms for one well known make of automobile. After various machining operations required on the casting, the ends

(*Concluded on page* 96)

ADVERTISING PAGES REMOVED

Blistering Porcelain Enamel

(*Concluded from page* 35)

carbides is of such a degree that a gradual dissociation takes place throughout the enamel firing period, will blister. Irons exhibiting the latter characteristic have been termed poor annealing irons.

The greater majority of blistering castings have a thin skin or *micro chill* in which the carbides are comparatively more stable than those in the body of the casting, and this condition is illustrated plainly in the case mentioned in this article.

Two stove door castings were brought to our attention. No. 1 had never been enameled, but No. 2 had been enameled twice and had blistered badly both times. Drillings were taken from both castings for chemical analysis with the results shown in the following table:

	No.1 (raw)	No. 2 (enameled)
Silicon	2.63	2.40
Sulphur	.070	.097
Phosphorus ..	.73	.71
Manganese ...	.57	.58
Total Carbon..	3.38	3.40

As usual, there is nothing in these analyses to explain any difference in enameling behavior. Both irons are hypereutectic with No. 1 slightly more so than No. 2.

Compare Halves of Casting

Casting No. 1 was sawed in half, and one half of it enameled with the same enameling procedure as used on casting No. 2. It enameled perfectly without blistering. Sections were then made of casting No. 1 before and after enameling and of No. 2 which had been enameled twice. The heat treatment that the iron receives due to the enameling operation consists of heating to 1300 degrees Fahr. for 30 minutes, allowing to cool to room temperature and then another heating up to 1260 degrees Fahr. for 25 minutes and again cooling to room temperature.

In Fig. 1 the etched structure of casting No. 1 in the raw condition is shown, and Fig. 2 is a view of the same iron after enameling. Part of the enamel layer may be seen in this figure. It will be noted that there has been apparently a complete breakdown of the pearlite during the enameling process. Evidently the carbides were very unstable and broke down rapidly.

However, in Fig. 3, a section showing the enamel-iron interface of the blistering casting, there is still a large amount of undecomposed pearlite visible at the surface, although decomposition is complete toward the center. The structure of the iron is shown at a high magnification in Fig. 4. The pearlite in this figure shows slight decomposition with the undeveloped ferrite grain boundaries visible in places. This pearlitic structure persists in spite of two heatings, a subsequent removal of the enamel by sand blasting and then a second series of heatings and coolings. In Fig. 5 the structure of the iron at a spot near the center of the casting discloses only ferrite, graphite, and steadite.

Just what causes this microscopic layer of very stable carbides is still a mystery. The analysis shows the irons to be of approximately the same composition and both were cast in the same size section from the same cupola. The recent work of Boyles[3] opens up an interesting new avenue of thought about this. He states that the structure of cast iron is profoundly altered by the presence of hydrogen which increases carbide stability.

When we consider that every time molten iron is poured into a green sand mold, appreciable amounts of hydrogen are formed from the decomposition of the water in the sand, and this hydrogen is generated in intimate contact with the iron, then it might seem possible that this may have some connection with *micro chill*.

1. "Blistering Phenomena in the Enameling of Cast Iron," A. I. Krynitsky and W. N. Harrison; Journal American Ceramic society, vol. 13, No. 1—January, 1930.
2. "The Blistering of Cast Iron Enamel," Emmerson P. Poste; Journal American Ceramic society, vol. 16, No. 6—June, 1933.
3. "The Freezing of Cast Iron," Alfred Boyles; American Institute of Mining and Metallurgical Engineers, Tech. Pub. No. 809.

Faked Foundry Facts

"Bottom Board"

Elects New Officers

At the National Safety congress held recently in Kansas City, Mo., the metal section of the National Safety council elected the following officers: General chairman, R. A. Chaffin, Continental Steel Corp., Kokomo, Ind.; vice chairman, Mell E. Trammell, Republic Steel Corp., Alabama City, Ala.; secretary and *News Letter* editor, H. J. Griffith, Jones & Laughlin Steel Corp., Pittsburgh; health committee chairman, Dr. R. C. Engel, Republic Steel Corp., Cleveland; membership committee chairman, Fred Warr, Carnegie-Illiinois Steel Co., Pittsburgh.

Program committee chairman, R. H. Ferguson, Republic Steel Corp., Cleveland; publicity committee chairman, John O'Rourk, Bethlehem Steel Co., Sparrows Point, Md.; statistics committee chairman, H. J. Spoerer, Youngstown Sheet & Tube Co., East Chicago, Ind.; railway car builders committee chairman, P. J. Brand, Pullman Standard Car Mfg. Co., Pullman, Chicago; contest committee chairman, Robert L. Schmitt, Louisville Car Wheel & Railway Supply Co., Louisville, Ky.; and foundry committee chairman, Irvin A. Brinkman, Mackintosh-Hemphill Co., Pittsburgh.

Members at large include the following who are associated with the foundry field: F. G. Bennett, Buckeye Steel Castings Co., Columbus, O.; J. A. Coltrin, National Radiator Corp., Johnstown, Pa.; M. W. Dundore, Beloit Iron Works, Beloit, Wis.; O. F. Harvey, American Car & Foundry Co., New York; and A. C. Schultz, Bucyrus-Erie Co., South Milwaukee.

Refractory Data

Harbison-Walker Refractories Co., Pittsburgh, recently has published the second edition of its "Modern Refractory Practice." The volume, which is 7⅞ x 10¾ inches in size, contains 295 pages, and relates to the various refractories manufactured by the firm, and describes some activities of the firm. Detailed information of each type of refractory made by the company is presented, and covers such materials as fire clay refractories, high alumina refractories, silica refractories, magnesite refractories, chrome and forsterite refractories, special clays, mortar materials and ramming mixtures, acid proof brick and tile and insulating materials. Other sections in the book discuss use of the firm's products in furnace construction, selection and use of refractories, and refractories and their properties. In addition, the book contains numerous formulas used in calculating brick work.

Slagging The Cupola

(*Concluded from page* 37)

moving the material which has frozen between taps. In some instances composition of the slag is responsible, but in the majority of cases operating trouble may be traced to the location of the slag hole, 1½ or 2 inches below the level of the tuyeres where the chilling effect of the cold air on the slag is greatest. Blocking off any air currents in the vicinity is helpful, but the best solution of the problem is to lower the slag hole to approximately 6 inches below the tuyere line. This will reduce the storage capacity of the cupola and involve more frequent tapping and slagging with consequent higher temperature in the slag hole and elimination or reduction in the use of the poke bar. In some instances the distance from the top of the slag hole to the bottom level of the tuyeres is 9 inches.

The front slagging spout is not new, but until recently was employed successfully only in a small number of foundries. Recently interest has been growing in this method of slagging the cupola through a combined tapping and slagging spout. Essentially the device is a tapping spout which differs from the usual type of spout in that the outer end is higher than the tap hole. A dam is inserted at a suitable point to divert the slag and remove it through an opening in the side of the spout between the tap hole and the dam.

A cupola with a melting rate of 2 tons per hour or even less, may be operated readily and continuously with this type of spout. Correctly designed, the storage capacity of the spout may be held down to 150 pounds. If necessary the upper limit may equal the capacity of a reservoir ladle. In many cupola installations the distance between the end of the spout and the floor is not sufficient to accommodate a reservoir ladle. Change over to the slagging type spout would remedy this condition since the outer end will be from 6 to 10 inches higher than the end of the ordinary type spout.

No definite relationship needs to exist between the melting rate of the cupola, and the diameter of the tap hole in a front slagging spout. A tap hole 1-inch high and 2-inches wide will serve satisfactorily whether the cupola is melting 5 or 25 tons per hour. Only a small reservoir of iron and slag is maintained in the well of the cupola. Where the spout is designed properly, the metal in the inside of the cupola does not extend more than ½-inch above the tap hole. This type of spout sometimes is called a siphon spout. Foundrymen who are not familiar with the method find difficulty in understanding how slag can be removed through an opening filled with flowing metal. Attempted explanation has been based on siphonic action. As a plain matter of fact there is no siphonic action. The head of metal and slag in the cupola is just sufficient to seal the tap hole from air currents. Consequently both the slag and iron readily can flow through at the same time.

Under the foregoing conditions, slag accumulation is as far from the tuyeres as it is possible to get it. Also the slag is in contact with the hottest metal, the ideal condition for slag removal.

After satisfactory slagging condition has been established, the problem of handling and disposing of the waste material still remains. The solution of the problem seems to be one of economics. Under average condition from 60 to 90 pounds of slag appear with each ton of iron melted. Thus a foundry melting 10 tons of iron per day, has to dispose of 600 to 900 pounds of slag, while the foundry melting 200 tons per day faces the problem of getting rid of 6 to 9 tons of this waste material.

In many instances the slag from the spout or slag hole is allowed to spread on the foundry floor. This is sloppy practice. In summer it raises the already high temperature in the vicinity. It involves more labor in unnecessary handling. Slag readily may be handled in unlined cast iron ladles, mounted either on individual pairs of wheels, or suspended from a monorail. In the larger foundries, slag frequently is introduced into water as soon as possible after it leaves the cupola. The water may be in a tank equipped with a removable, perforated bucket, or equipped with a perforated bucket conveyor. The water falls back into the tank while the conveyor dumps the slag into cars or trucks. In some installations the slag from several cupolas is distintegrated by streams of water.

Selection of a suitable slag handling system depends on the number of cupolas in operation, location in the foundry, cost of water, and accessibility for installation of equipment in the vicinity.

Diameter of Tap Hole

Melting Rate Tons/Hour	Diameter Tap Hole	Melting Rate	Diameter	Melting Rate	Diameter	Melting Rate	Diameter
4	13/32	10	41/64	16	13/16	22	61/64
5	29/64	11	43/64	17	53/64	23	31/32
6	1/2	12	45/64	18	55/64	24	1
7	17/32	13	47/64	19	57/64	25	65/64
8	37/64	14	49/64	20	29/32	..	.....
9	39/64	15	25/32	21	59/64	..	.....

Anneals Castings Rapidly

(*Concluded from page* 92)

are given a flash heat around 1600 degrees Fahr. and quenched which produces an extremely hard surface at those points. While several methods can be used to produce pearlitic malleable iron, present indications are that the arrested anneal type will be produced. In that method, the hard castings are subjected to heat treatment somewhat similar to the regular anneal except that the castings are withdrawn from the furnace at temperatures ranging from 1350 to 1525 degrees Fahr., and quenched in air.

Tensile strengths ranging from 80,000 to 90,000 pounds per square inch with elongations from 5.0 to 2.5 per cent, and brinell hardness numbers from 180 to 248 respectively have been obtained with the temperatures mentioned previously; the low strength, high elongation, and low brinell being obtained with the lower temperature withdrawal. Heat treatment of the pearlitic malleable iron is being conducted in a 1-ton batch type, radiant tube furnace shown in Fig. 16.

Keep Track of Costs

(*Concluded from page* 84)

or in snap flasks, number of bands handled and shaken out, chills removed from the castings, number of cores, price received by night men for different flasks, and operations necessary to deliver the castings to the cleaning room.

The night men's record sheet is shown in Fig. 9. This sheet gives complete information of all molds poured and not poured during the day, the class of molds and flasks and other information pertaining to the pay of the shakeout crew. For example squeezer floor No. 1 shows 180 molds reported by day clerk. The night count shows 80 molds with a single band and 100 molds with two bands.

Substantial Help

● These days, when profits must be literally dug out of operating costs, many Foundrymen are finding substantial help in the savings they get with Baker Industrial Trucks. The number bought this year is significant of the importance placed on these economical, long-lived units.

Get the facts on handling economies from the Baker Materials Handling Engineer. His authentic, detailed records cover savings made in many plants. They will be helpful in determining your own cost-cutting possibilities. *Write* BAKER INDUSTRIAL TRUCK DIVISION, BAKER-RAULANG COMPANY, *2161 West 25th Street, Cleveland, Ohio.*

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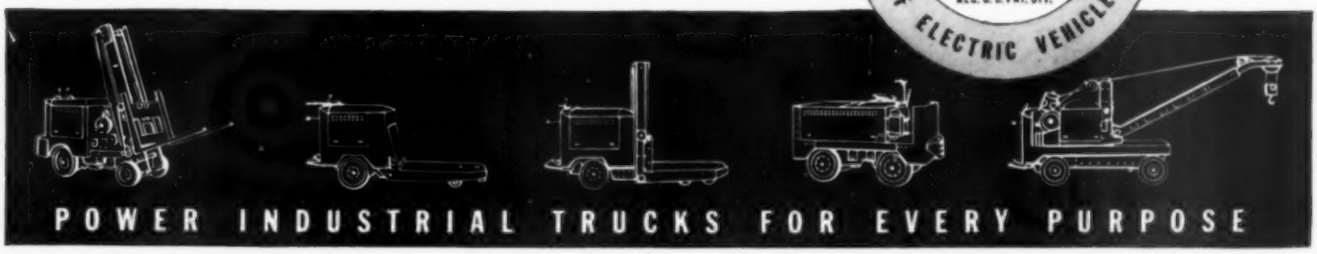
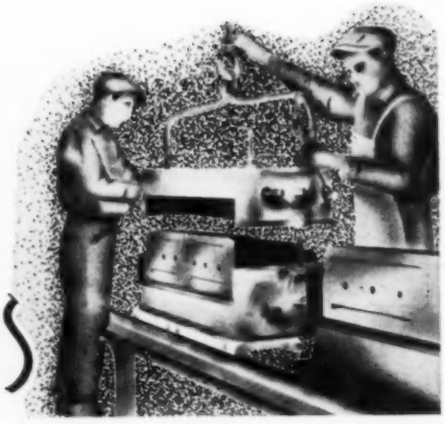
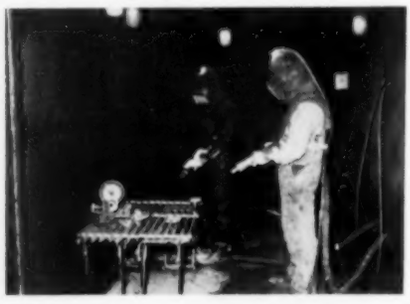


New Equipment for Foundries



Rubber Covering

Plymouth Rubber Co. Inc., Canton, Mass., has developed a special rubber wall covering for abrasive blasting rooms in foundries. The



Rubber wall covering resists wear of abrasives used in blast cleaning of castings

wall covering material is made in slabs 24 x 36 inches, and is applied to the sheet steel or other materials used in the construction of the blasting room. It is claimed that the rubber wall covering is compounded with ingredients which resist the wear of various abrasives employed in blast cleaning. The accompanying illustration shows the interior of a blasting room lined with the special rubber wall covering.

Hand Truck

Sabin Machine Co., 6538 Carnegie avenue, Cleveland, recently has placed on the market a truck, shown in the accompanying illustration, and adapted for convenient and speedy handling of wood or steel barrels and drums from keg size to 36 inches high. The truck carries a hood and tongue member adjustably mounted on the vertical column. In operation the tongue is positioned about 1-inch above the lower edge of the barrel chine while the truck is held against the barrel at top and bottom.

The hook is placed over the edge of the barrel and the wheels allowed to roll back until the tongue slips under the lower edge of the chine. With the handle and foot pedal the wheels are pushed up to the load which is thus raised from the floor and attached to the truck. It is then easily tipped to the balancing position.

Wheels are 3 x 10 inches mounted on roller bearings and supplied with steel, hard rubber or pneumatic tires. The axle is 1¼-inches in diameter and the overall width of the truck is 25 inches and is particularly adapted for operation in restricted spaces. It is claimed that

Adjustable hook and tongue member grips the load

with this truck one man readily can pick up and transport loads up to 900 pounds.

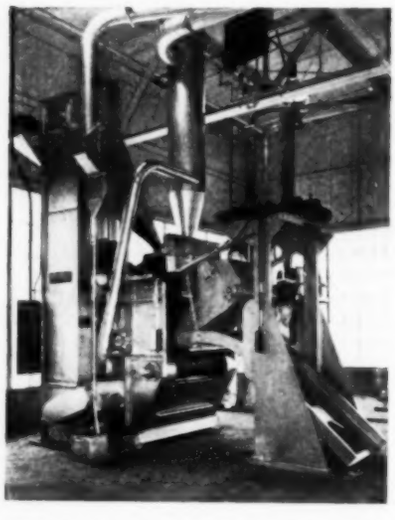
Welding Helmet

Willson Products Inc., Reading, Pa., has introduced a welding helmet formed of one-piece black vulcanized fiber and cut deeply to offer side protection to a point well back of the ears. The unit is designed so that a smooth, rounded interior promotes air circulation and results in a well-ventilated, cool, comfortable helmet. The company is making several different styles of helmets in one-piece construction and the line also includes one-piece handshields.

Abrasive Cleaning

American Foundry Equipment Co., Mishawaka, Ind., recently has placed on the market a new model of its abrasive blast cleaning equipment. New features are claimed to have been incorporated in the design of this unit. Centrifugal force is utilized in whipping steel abrasive on the metal pieces being cleaned, and a gentle tumbling and complete exposure of all parts in the blasting zone is attained by use of an endless conveyor apron.

A change in design of the suction type abrasive separator is included at the elevator head as standard equipment. That cleans the abrasive by removing dust and broken-down abrasive after burned molding sand, forging scale, and other foreign material is extracted by a rotary screen. The cleaning unit with the standard conveyor will clean metal parts weighing up to 30 pounds. Pieces weighing as much as 75 pounds also can be cleaned when the machine is equipped with a heavy-duty conveyor.



Improved suction type abrasive separator is included in the elevator head

This CRANE takes no *"Wheel Holidays"*

"WHEEL Holidays" in the modern machine shop are virtually a thing of the past. The reason is simple. Shop superintendents are now using USS Wrought Steel Crane Wheels — because they outlast ordinary wheels by approximately 2½ to 1.

The results are gratifying. Fewer tie-ups for crane-wheel maintenance. No bottle-necks in production. Shop men lose less time. Work progresses steadily. Shipments go out on time. Profits are consistent.

USS Wrought Steel Crane Wheels are now standard equipment on the largest, best-known cranes in the country. Their service records prove beyond question that they are both safe and economical. To keep "Wheel Holidays" to a minimum, specify these long-mileage wheels both for new equipment and for replacements.

USS Wrought Steel Crane Wheels, double flange or single flange, are furnished rough machined, finish machined, or finish machined with finish bore and keyway—rim-toughened or untreated, as desired.

Look for the letters "R.T.", stamped on the rim. They mean "Rim-toughened" by the USS process to assure lasting hardness, safety, and long wear.

U·S·S WROUGHT STEEL CRANE WHEELS

CARNEGIE-ILLINOIS STEEL CORPORATION

Pittsburgh *Chicago*

Columbia Steel Company, San Francisco, *Pacific Coast Distributors*

United States Steel Products Company, New York, *Export Distributors*

UNITED STATES STEEL

Matchplate Vibrator

A new type matchplate vibrator, presenting several interesting features and shown in the accompanying illustration, recently has been

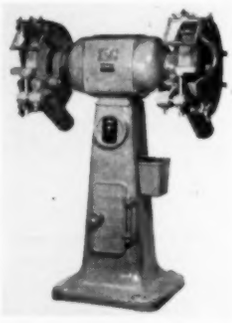
Cut-away view of vibrator showing bronze bushing, also rectangular intake and exhaust ports

placed on the market by the Kindt-Collins Co., 12697 Elwood Ave., Cleveland. The device is supplied in four sizes, ½, ⅝, ¾ and 1-inch. A tough, extra heavy steel body is bored out leaving only one open end into which is inserted a special alloy bronze bushing. A rust resisting hardened and precision ground piston is fitted into this bushing. It is claimed thtat the rectangular intake and exhaust ports produce more than ordinarily rapid and powerful vibration.

Accurately cut threads insure a tight permanent fit between the cap and body. Twin exhaust holes at each end diffuse the air and prevent entrance of sand. The entire body is cadmium plated to prevent rust. It is claimed that it starts instantly and will last almost indefinitely even without lubrication. A special type hose also has developed in connection with the vibrator. It is stated that the hose will withstand pressure up to 1000 pounds per square inch, while the cadmium plated machined steel fittings rolled on to the hose will withstand air pressure of 1400 pounds per square inch.

Electric Grinder

James Clarke Jr., Electric Co., Louisville, Ky., recently has added the three-horsepower floor grinder, shown in the accompanying illustration, to its line of industrial grinding equipment. Interesting features include hood adjustable for wheel wear and shatter proof glass for eye protection. It is stated that this grinder is adaptable for either production work or general tool grinding.



Shatter proof glass over the wheels protect the eyes of the operator

The rotor shaft is mounted in heavy duty precision type ball bearings, grease lubricated. Overall housings adequately protect the bearings against the entrance of grit and dirt. The motor is totally enclosed and is rated at 3 horsepower for constant duty at 1750 revolutions per minute. Maximum wheel wear and maximum clearance for work is provided by the small diameter of the motor frame. A micrometer set attachment for grinding twist drills up to 1¼-inch diameter, also can be furnished with the grinder.

Adjustable Jacket

An adjustable and flexible taper flask jacket, supplied in either cast iron or aluminum, has been de-

Adjustment is secured through bolts in the corners

veloped by C. H. Bester, 414 North Detroit street, Xenia, O. The jacket, shown in the accompanying illustration, is made in a wide range of sizes from 10 x 10 to 24 x 24 inches and in depths from 4½ to 9 inches. It is claimed the jacket will adjust itself to tapers of from 1 to 10 degrees. The long bolts in the corners permit adjustment in size, for example a 12 x 14-inch jacket may be extended for a 12 x 15, a 13 x 14 or a 13 x 15-inch flask. The head of the round ball bolt fits in a socket and is provided with a wrench seat.

New Microscope

A metallurgical microscope which it is claimed, brings to the foundry an economical and simplified high grade instrument for examination of polished and etched metal samples, and which also may form part of a photomicrographic unit now is available through the H. W. Dietert Co., 9330 Roselawn avenue, Detroit. Net weight of the instrument shown in

Metallurgical microscope is simplified instrument

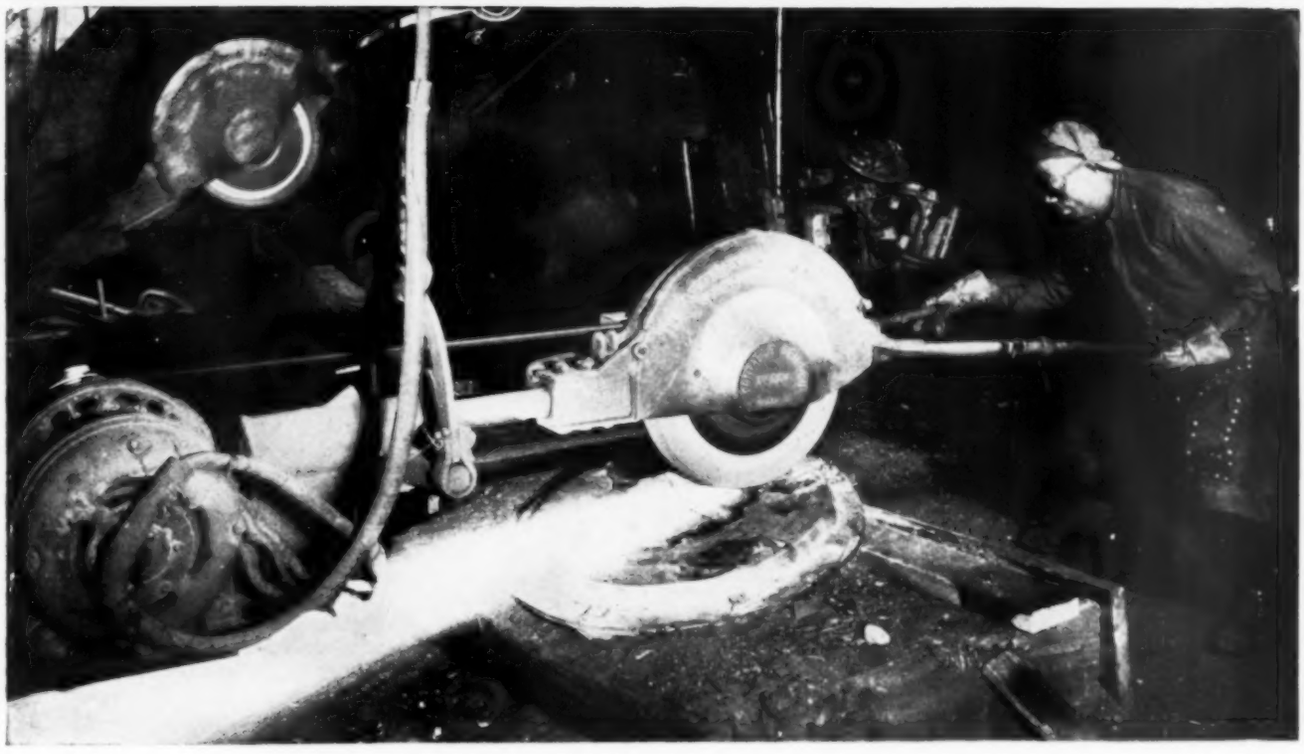
the accompanying illustration is 8.4 pounds, height 10 inches, electric current required to operate, 110 or 220 volts. Standard magnifications are 100 and 500 diameters, but other magnifications are available. The instrument is furnished with a vertical illuminator with resistance unit; 16 millimeter and 4 millimeter achromatic objective; 10 diameter and 12.5 diameter Huygenian eye pieces.

Shop Light

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has designed a new type of light for installation in plants where dust and fumes require continual servicing of standard lighting equipment. The light, which is shown in the accompanying illustration, is said to be dust-tight and vapor-proof so that there is no flue action in the unit to impair the reflector. An occasional wiping of the glass lens restores it to its original output. The unit is equipped with a glass lens which is claimed to be capable of withstanding severe shock and extreme temperature changes. The reflector is portected by a steel housing.

Light is designed for installation where dust and fumes require continual servicing of standard equipment

MACKLIN
Grinding Wheels



Macklin Grinding Wheels will "Protect your Production" on all types of grinding jobs. Wheels of proper grain, grade and structure for swing frame grinders give fast and cool cutting action and long life. Macklin Grinding Wheels are economical and efficient for all foundry operations.

MACKLIN COMPANY

Manufacturers of Grinding Wheels

JACKSON, MICHIGAN, U. S. A.

Sales Offices:—Chicago - New York - Detroit - Pittsburgh - Cleveland - Cincinnati - Milwaukee - Philadelphia

Flow Meter

American Gas Furnace Co., Elizabeth, N. J., is manufacturing flow meters for measuring the flow of air and gases to obtain better control of gas burning operations and carburizing. In the meters as shown in the accompanying illustration, a float rides in a transparent, calibrated, tapered tube. The flow of the gases supports the float at some position in the tube, depending upon the quantity of air or gas passed.

The position of the float indicates the flow and permits direct reading of the volume in cubic feet per hour. The entire flow of air or gas is thus measured and possibility of error is eliminated. The pyrex glass tube, which has been carefully calibrated in conjunction with the float provided with it, is mounted in a vertical position in a casting with standard pipe thread.

Installation is made directly in the line, using an inlet at the bottom and outlet at the top, or alternative outlet at the bottom. The flow meters are calibrated to read directly in cubic feet of gas per hour and, unless otherwise specified, are calibrated for 0.60 specific gravity city gas at a pressure of 4 to 6-inch water column. Correction factors for other pressures and other specific gravities are supplied with each unit or flow meters can be calibrated for gases of a given composition.

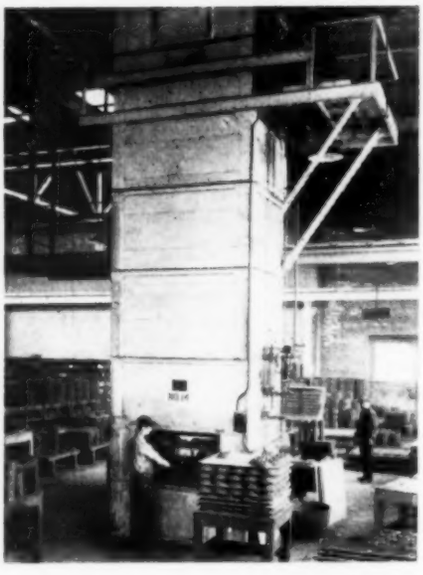
Flow meter measures the quantity of air and gases

Portable Pyrometer

A new, millivoltmeter-type, portable indicating pyrometer recently has been placed on the market by the Bristol Co., Waterbury, Conn., for measuring temperatures up to 3000 degrees Fahr., using a thermocouple and extension leads. It is claimed that use of a cobalt magnet permits exceptional design features including increased sensitivity and widened scale for more accurate readings. Sensitivity is accomplished without need for critical leveling adjustments, and without sacrifice of ruggedness. The high resistance, millivoltmeter movement is double-pivoted, and completely shielded to prevent the effects of stray fields. The molded Bakelite case is moisture and dustproof.

Pyrometer is sensitive, rugged and accurate

★ ★ DSM ★ ★



Small Vertical Ovens for core paste or black wash drying.

•

Oil or Gas Fuel

Compact

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Low Fuel Cost

•

Easily Installed

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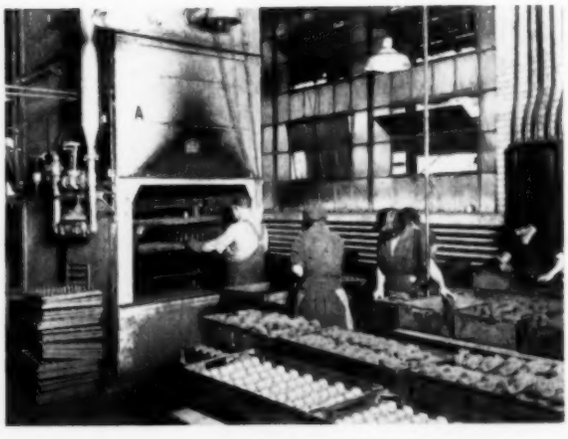
Speedier Production

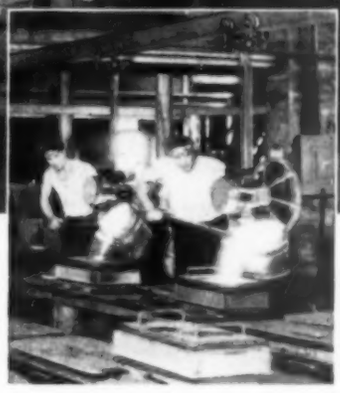


DETROIT SHEET METAL WORKS

DETROIT - - MICHIGAN

1270 Oakman Boulevard

OF POURING STEEL WITH A MODERN POURING DEVICE



to the laborious high cost method of hand shanking. Hard work is eliminated; greater accuracy in pouring prevents many castings losses; practical ladle covers conserve the heat of the metal preventing cold shuts and shielding the operators from heat and gases; overcoming a good deal of labor discontent.

Conveyor Pouring

The insert photo to the right shows a Modern Pouring System used for pouring molds on power conveyor traveling at a rate of 27 ft. per minute. Pouring costs are reduced to an absolute minimum.

It is impossible to realize full results from any conveyor molding unit without providing a Modern Pouring System for pouring the molds.

Write today for further information on Modern Pouring Equipment.

MODERN

Covered and Insulated Ladles

Lifetime Geared Ladles

Improved Bottom-Pour Ladles

Metal Pouring Systems

Crane and Monorail Systems for Metal and Mold Handling

Furnace Charging Cranes

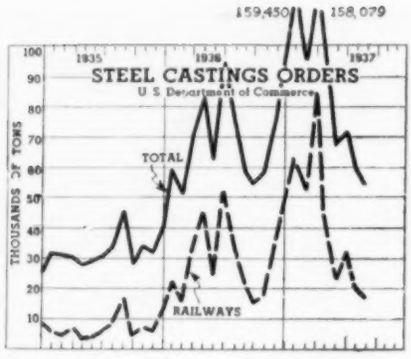
Sand Conditioning Systems

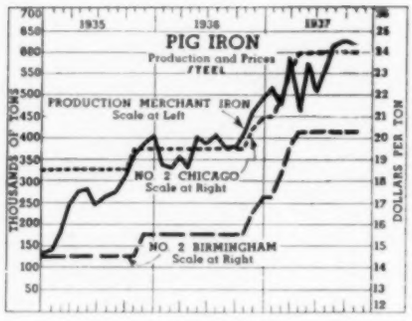
Patented & Patents Pending

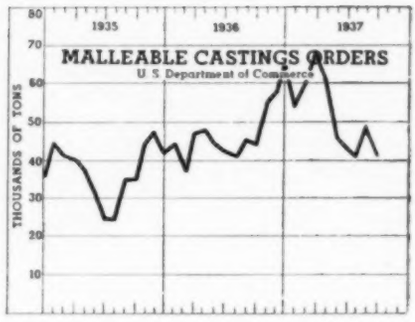
MODERN EQUIPMENT COMPANY

PORT WASHINGTON, WIS., DEPT. 136

MODERN EQUIPMENT CO.







FOUNDRY ACTIVITIES

FORD MOTOR CO., Dearborn, Mich., will build a new cast alloy steel foundry which will cover approximately eight acres and will increase the floor space of the Ford foundry to 38 acres. The new building will house equipment for casting alloy steel parts, the use of which in motor cars was pioneered by Ford 4 years ago with the introduction of cast steel alloy crankshafts for V-8 engines. Numerous other parts, formerly forged, are now cast of special steel alloy developed by Ford. In connection with this development the present electric furnace building will be converted to supply molten steel alloy for use in the casting processes in the new foundry addition.

* * *

Buick Motor Co., Flint, Mich., is planning erection of a 1-story addition to its plant.

* * *

Manning Pattern Co., Waterloo, Iowa, will build a 1-story plant addition.

* * *

Ampco Metals Inc., 3820 West Burnham street, Milwaukee, is building an addition 80 x 200 feet, principally to house a laboratory and metallurgical department. A cleaning room and metal storage room will be enlarged and a new and modern pattern room installed. Another addition is under contract 50 x 100 feet. Total increase in space is approximately 25,000 square feet. Carl Zaiser is president and general manager.

RAW MATERIAL PRICES

Nov. 2, 1937

Iron	
No. 2 foundry, Valley	$24.00
No. 2 Southern Birmingham	20.00
No. 2 foundry, Chicago	24.00
No. 2 foundry, Buffalo	24.00
Basic, Buffalo	23.00
Basic, Valley	23.50
Malleable, Chicago	24.00
Malleable, Buffalo	24.50
Charcoal iron, furnace	27.00
Coke	
Connellsville beehive premium	$ 5.75 to $ 6.25
Wise county beehive coke	6.25 to 6.50
Detroit by-product delivered	11.10
Scrap	
Heavy melting steel, Valley	$16.00 to $16.50
Heavy melting steel, Pitts. (dlv.)	14.75 to 15.25
Heavy melting steel, Chicago	13.75 to 14.25
Stove plate, Buffalo	11.50 to 12.00
Stove plate, Chicago	10.00 to 10.50
No. 1 cast, New York	13.50 to 14.00
No. 1 cast, mchy., Chicago	13.50 to 14.00
No. 1 cast, Pittsburgh	16.50 to 17.00
No. 1 cast, Philadelphia	19.50 to 20.00
No. 1 cast, Birmingham	15.50 to 16.00
Car wheels, iron, Pittsburgh	16.00 to 16.50
Car wheels, iron, Chicago	16.50 to 17.00
Railroad malleable, Chicago	16.00 to 16.50
Malleable, Buffalo	15.50 to 16.00
Nonferrous Metals	**Cents per pound**
Castings copper, refinery	11.27½
Straights tin	46.25
Aluminum, 99 per cent	20.00
Aluminum, No. 12 (Secondary, standard)	18.00 to 18.50
Lead, New York	5.50
Antimony, New York	17.25
Nickel, electro	35.00
Zinc, East St. Louis, Ill.	5.75

John Deere Tractor Co., Waterloo, Iowa, is building an addition to the foundry building at the tractor manufacturing works.

* * *

C. Rasmussen Inc., King George's road, Fords, N. J., is reported planning to open a foundry in the near future.

* * *

Square Deal Brass Foundry Co., Detroit, has been incorporated to manufacture aluminum, bronze, etc. by Steven J. Gergely, 20181 Omira Ave.

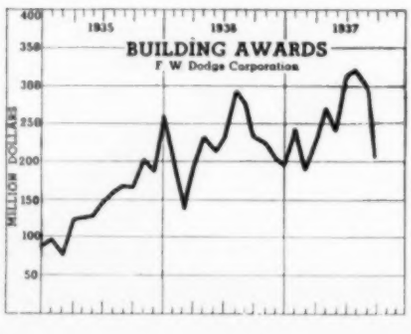
* * *

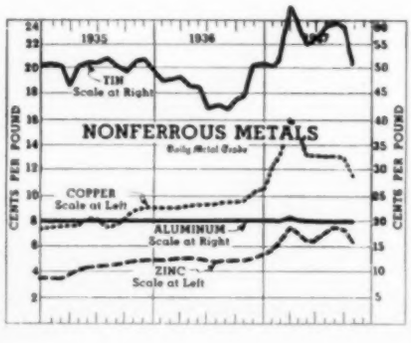
Twin City Foundry, Aberdeen, Wash., recently was destroyed by fire. C. N. Wilson, manager, asserted that the foundry would be rebuilt.

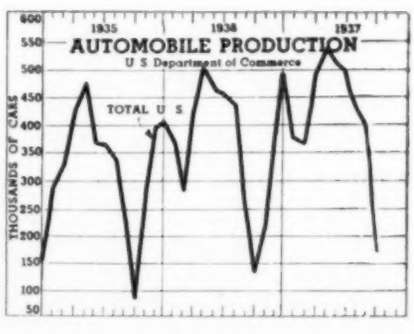
* * *

Index of foundry equipment orders for September, according to a report of the Foundry Equipment Manufacturers' association, Cleveland, was 231.8 as compared with 257.5 in August and 161.0 in September, 1936. Index of shipments for September was 235.4 as against

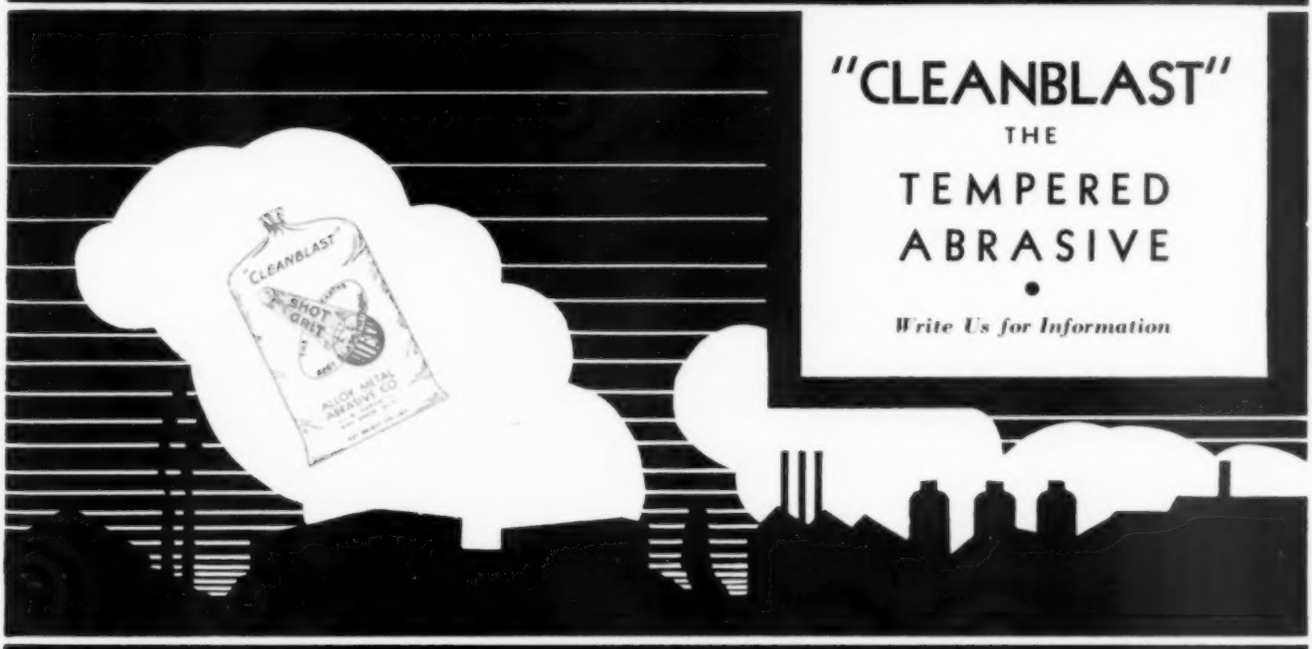
(Continued on page 106)







SHOT "CLEANBLAST" GRIT



"CLEANBLAST"
THE
TEMPERED
ABRASIVE
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Write Us for Information

ALLOY METAL ABRASIVE COMPANY 311 W. HURON ST., ANN ARBOR, MICH.

ONE WAY TO CUT YOUR COSTS

It's a big problem today to operate a foundry and make a profit. With increased labor costs and higher prices for materials it becomes necessary to make savings wherever possible. One way you can save is to use

FORD CHARCOAL BRIQUETS

They'll prove their economy for drying molds — for covering pouring ladles — for preheating castings to be welded. Ford Briquets are highly compressed charcoal made from hardwoods. Heat value is high. They don't crumble. There's no dust. They are easily salvaged after partial burning. That's why they save you money. Write us and we'll gladly supply more information.

Ford

FORD MOTOR COMPANY • *By-Products Division* • Dearborn, Michigan

(*Continued from page* 104)

266.6 for August and 150.5 in September of the previous year.

* * *

Tappan Stove Co., Mansfield, is planning to build a two-story, 70 x 180 foot factory to cost approximately $70,000 with equipment.

* * *

Sealed Power Corp., Muskegon, Mich., is planning to erect a foundry. Giffels & Vallet Inc., L. Rossetti, Detroit, are the engineers and architects.

* * *

Standard Stoker Co. Inc., Erie, Pa., is receiving bids for the erection of a one-story machine shop 65 x 185 feet, to cost about $50,000 with machinery.

* * *

Reliable Patterns & Castings Co., Cincinnati, has been licensed by Sims Matchplate Co., Syracuse, N. Y., to manufacture and sell semidie cast patterns.

* * *

Blaw-Knox Co., Blawnox, Pa., recently has announced a change in the corporate relationship of its domestic subsidiaries, effective Nov. 1. The subsidiaries of Blaw-Knox Co. will be known as divisions. Officers of the former subsidiaries will retain their respective status. Subsidiaries affected include. Lewis Foundry & Machine Co., Pittsburgh; National Alloy Steel Co., Blawnox; Pittsburgh Rolls Corp., Pittsburgh; Union Steel Casting Co., Pittsburgh; Power Piping Corp., Pittsburgh. William P. Witherow is president of the Blaw-Knox Co.

* * *

Chicago Die Casting Co., 2512 West Monroe street, Chicago, is building a two-story factory addition at an estimated cost of between $35,000 and $40,000.

* * *

Oscar W. Hedstrom Pattern Works, 4836 West Division street, Chicago, recently has added a nonferrous foundry to its pattern manufacturing facilities.

* * *

Electro Alloys Inc., 11114 South Michigan street, South Bend, Ind., has been incorporated to operate a foundry. Incorporators are William H. Shaw, Arline Bennett and Donald Bennett.

* * *

Sandwich Foundry, 3435 Bloomfield street, Windsor, Ont., has been granted a permit to construct a $10,000 addition to its foundry. It will be of brick and steel, 64 x 68 feet.

* * *

International Harvester Co., Springfield, O., is planning to build a new factory, including installation of new equipment, according to R. M. Watkins, superintendent. The cost will be approximately $750,000.

* * *

King Union Co., Hillsgrove, R. I., is building several additions to its plant including a storage building, a machine shop addition and a two-story addition to the foundry building.

* * *

Precision Casting Co., Cleveland, is planning to build a 1-story, 60 x 130-foot factory addition at 12600 Berea road. Cost is estimated at $40,000. J. R. Millspaugh is general manager.

* * *

Doehler Die Casting Co., New York plans construction of a plant in Batavia, N. Y., for the production of brass and magnesium castings. Total cost will exceed $100,000.

* * *

Production of gray iron castings increased 6.4 per cent during September, according to reports received by the Industrial Research department of the University of Pennsylvania. However, production of steel castings declined 4.4 per cent during September, reversing

(*Concluded on page* 108)

CORE MAKING economies follow quickly when you use durable lightweight core plates! They provide the savings that come with long, efficient service . . . the increased production that comes with easier handling.

Made of a specially treated combination of asbestos and cement, J-M Transite Core Plates are inherently durable . . . offer maximum resistance to cracking and breaking . . . are permanently free from corrosion . . . and there is little, if any, warping.

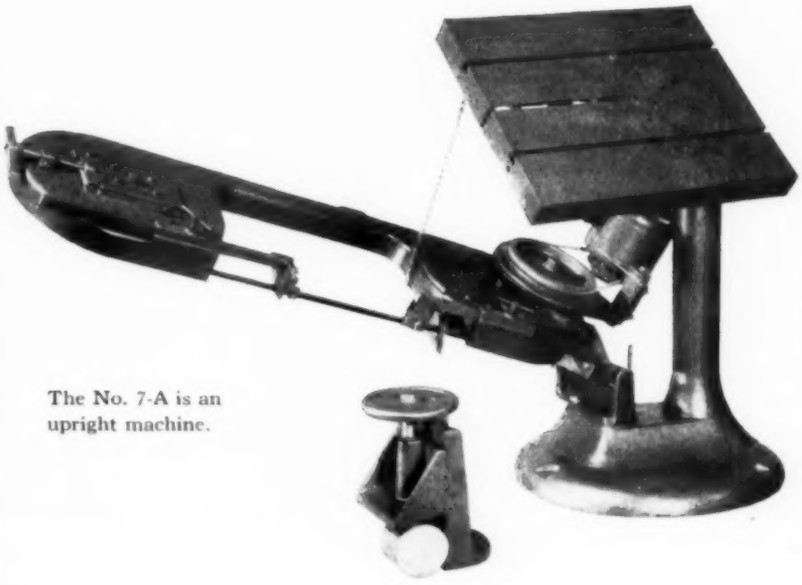
Yet, this is only half the story on Transite's contribution to lower core making costs . . .

Equally important is the fact that Transite Core Plates weigh only about a quarter as much as metal of equal thickness. Core makers actually carry *twice as many* with considerably less effort! Result . . . up goes production capacity . . . down go core making costs. For complete details, send for our free brochure. Write Johns-Manville, 22 E. 40th Street, New York City.

Johns-Manville
TRANSITE CORE PLATES
JM

SPRUES! GATES! RISERS!

CUT THEM WITH A "WELLS"



The No. 7-A is an upright machine.

● Especially adaptable to foundry requirements is our model No. 7-B for cutting gates, risers and sprues. It is adjustable to a wide range of positions. Tilting Table. Automatic feed. Speeds from 60 ft. to 1400 ft. per minute. Bands ¼", ½" or ¾" wide may be used.

Write for information to the

WELLS MANUFACTURING CORPORATION
THREE RIVERS, MICHIGAN

PANGBORN-NORBIDE★
"LONG-WEAR" BLAST CLEANING NOZZLES

Their superior, long-wearing qualities make the Pangborn-Norbide Nozzle an outstanding improvement for all blast cleaning equipment.

GUARANTEE
1500 hours service with steel abrasives—750 hours with sand.

Because these nozzles are lined with the hardest substance ever made by man, their long life effects an unquestionable economy.

There is a size and type to meet your every requirement. Detailed information and prices will be gladly furnished on request.

★Trade-mark of Norton Co. for Boron Carbide

PANGBORN CORPORATION
The World's Largest Manufacturer of Blast Cleaning and Dust Collecting Equipment
HAGERSTOWN - - - - MARYLAND

(*Concluded from page* 106)

the direction of the previous month's trend. Comparison of the current year's figures with those of a year ago, shows increase in activity in 1937. Total production was 14.5 per cent more than that of the previous year.

* * *

Title of Argos foundry, Argos, Ind., has been acquired by Norman C. Darnell, Jack Foggarty, Frank McGovern and Mr. Brockus. The company, which is expected to open the early part of November, will operate a foundry business, specializing in the manufacture of copper, brass, bronze and aluminum.

* * *

American Brake Shoe & Foundry Co., Fulton station, Baltimore, will erect a one-story addition and make improvements to its present plant at an estimated cost of $40,000, including equipment.

* * *

Arneson Foundry Inc., 6412 Thirty-third avenue, Kenosha, Wis., producers of steel and iron castings, will operate a nonferrous foundry through a newly organized affiliate headed by Thomas Arneson Jr. The new plant is being built at 3417 Fourteenth avenue, Kenosha.

* * *

J. I. Case Co., Racine, Wis., makers of tractors, farm implements, etc., plans construction of a new heat treating shop to be 130 x 500 feet, designed by Frank J. Hofman, architect. L. R. Clausen is president.

* * *

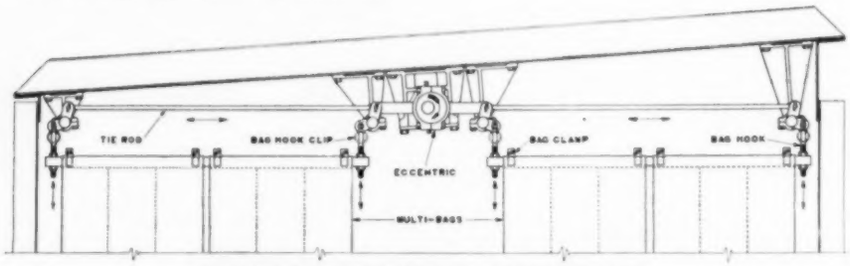
Geneva Metal Wheel Co., 127 Railroad street, Geneva, O., maker of wheels, axles and roller bearings for vehicles, is building a 65 x 100 foot one-story addition to be used as a warehouse for storage of finished product.

* * *

Evansville Brass & Aluminum Foundry Inc., 823 East Virginia street, Evansville, Ind., has been incorporated by Clifford V. McKelvey, Otto H. Butts and Jeston N. Butts to do a general brass, aluminum and foundry business.

In DRACCO DUST COLLECTORS FAN POWER is Reduced to a MINIMUM. Get Bulletin No. 302

The DRACCO Shaking Mechanism is unusually efficient; the upward and downward motion removes Dust that is hard to loosen. There is constant use of all effective cloth area for there are no frames or spacers to restrict flow of air. ALL THIS RESULTS IN LOW AIR RESISTANCE WHICH MAKES A SAVING IN FAN POWER. It will pay to find out what DRACCO Dust Control can do for you. With over 20 years experience to draw upon DRACCO Engineers are exceptionally well qualified to help you solve your particular problem.



DRACCO SHAKING MECHANISM

DRACCO DUST COLLECTORS are maintained ON THE CLEAN AIR SIDE

WORKED ON FILTER NOT MAINTAINED ON CLEAN AIR SIDE

WORKED ON FILTER MAINTAINED ON CLEAN AIR SIDE

• *Write for Bulletin No. 302* •

DRACCO CORPORATION

4050 E. 116th St., Cleveland, Ohio • New York Office, 130 W. 42nd St.

PNEUMATIC CONVEYORS • DUST COLLECTORS

Christmas Seals!

Buy and Use Them

Saginaw Malleable Iron Co., Saginaw, Mich., is planning construction of an office building. Frantz & Spence are architects.

* * *

Titus Foundry Co. Inc., Coldwater, Mich., has been purchased by the L. A. Darling Co. of Bronson. It is understood that the firm name will be changed and that the foundry again will be in operation in several months.

* * *

Pennsylvania Electric Steel Castings Co., Hamburg, Pa., plans repairing and alterations to its plant, the cost to exceed $50,000. The plant suffered damage from an explosion several weeks ago.

* * *

Electro-Forg-O-Mat Corp., Milwaukee, has been incorporated by Carl S. Zaiser, 1859 North Sixty-eighth street, president of Ampco Metals Inc., to manufacture forgings and castings. Associates are Herman Hahle and Joseph C. Brauer.

* * *

Clear Vision Pump Co. and the Hayes Equipment Mfg. Co., Wichita, Kans., have been combined under one management. Officers and directors of the new organization are J. T. Cronkhite, president; Roy Streeter, vice president; A. F. McMaster, secretary-treasurer, and Dr. D. I. Maggard, chairman of the board.

DIETERT DETROIT *Sand Testing* EQUIPMENT

MOISTURE TEST

Balance

Moisture Teller

Sand Rammer

PERMEABILITY—STRENGTH —MOLD HARDNESS TEST

Permeability Meter

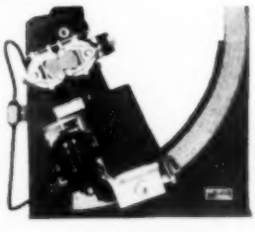
Universal Sand Strength Machine

Mold Hardness

CORE TEST

Core Test Oven

Core Hardness



Tensile Core Strength

PRACTICAL — ECONOMICAL — A. F. A. STANDARD

Write for more information

HARRY W. DIETERT CO.
9330 Roselawn Ave.
DETROIT, MICH.

A POSITIVE SOLUTION FOR THE CORE-BLOWING PROBLEM

Users of *Buffalo Brand Vent Wax* tell us that they positively wouldn't do without it because for the *few pennies per castings* that it costs, they have the positive solution to the core-blowing problem. It works wonders because it leaves a *clear, unobstructed vent hole* so that the *free, rapid passage of gases* is absolutely certain. And, we might add, you can make *cores in larger units* safely, and it's *easy to use!* Ask your dealer or write us direct for a liberal, *free sample*

UNITED COMPOUND COMPANY
BUFFALO

NEW TRADE PUBLICATIONS

Copies of any of the literature listed below may be obtained by writing directly to the companies involved, or by addressing THE FOUNDRY, in care of Readers' Service Department, 1213 West Third Street, Cleveland

MOLDING MACHINES—Data on its stationary and portable type jolt squeeze molding machines, jolt squeeze stripper machines, jolt rockover pattern draw and jolt squeeze rockover pattern draw molding machines are given in a catalog recently published by SPO Inc., East Sixty-first street and Waterman avenue, Cleveland.

SWITCHGEAR—General Electric Co., Schenectady, N. Y., has published a booklet on modern switchgear. The booklet contains information on air circuit breakers, oil circuit breakers, power switching equipment for indoors and outdoors, switches and devices, switchgear equipment and switchgear relays. Pertinent information as to features, sizes and uses is included.

V-BELTS—Booklet No. 795 on V-belt replacement for refrigerators, machine tools, stokers, air conditioning units, etc., has been issued by the Rockwood Mfg. Co., Indianapolis.

INSTRUMENTS—General Electric Co., Schenectady, N. Y., has published a folder on its small panel instruments for equipment manufacturers. The construction of a number of types is shown.

FURNACES—A well-illustrated and attractive booklet on gas fired furnaces in the automotive industries recently has been published by the Surface Combustion Corp., Toledo, O.

AIR BLAST EQUIPMENT—Pangborn Corp., Hagerstown, Md., has issued an illustrated folder showing typical installations and features of its line of air blast equipment together with its dust control units.

VACUUMS—An interesting folder on its vacuum cleaning systems for industrial use has been issued by the Spencer Turbine Co., Hartford, Conn. The various stationary and portable types are shown in use. Also several models are illustrated.

HOLDERS—Jackson Electrode Holder Co., 6553 Woodward avenue, Detroit, has published a folder on its insulated electrode holders. Various models are illustrated and the construction features are outlined. Information on replacement parts also is presented.

PUMPS—Oilgear Co., 1301 West Bruce street, Milwaukee, has published a new bulletin No. 47000 on its line of fluid power pumps and motors. The publication deals in detail with the construction of the pumps, operating features and a wide variety of applications.

ROD STRAIGHTENER—Bulletin No. 10 on a rod straightener and shear machine has been issued by the American Foundry Equipment Co., 555 South Byrkit street, Mishawaka, Ind. Features, models, operations and installations of this equipment are thoroughly covered photographically.

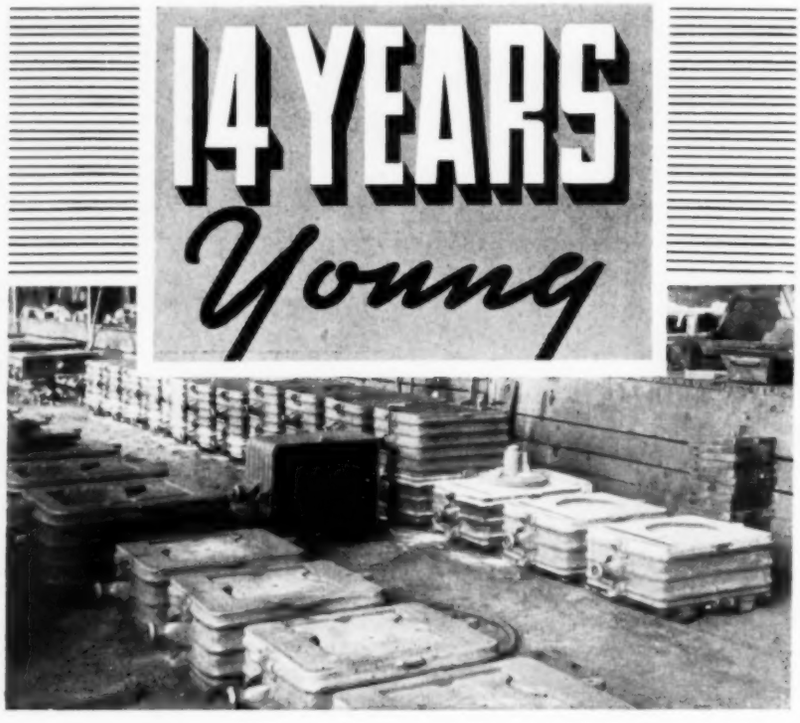
PULLEYS—An 8-page illustrated list price book No. 1622 recently has been published by Link-Belt Co., Chicago, on the subject of cast iron pulleys for power transmission. The booklet gives pertinent data on solid and split, single and multiple arm machine-molded pulleys with and without rubber lagging.

DIESEL ENGINES—Caterpillar Tractor Co., Peoria, Ill. has issued a booklet on diesel engine applications. Pumps, mines, hoists, sawmills, flour mills, generator sets, ice plants, oil wells, cotton gins, rock crushers, dredges and construction work are some of the specific applications which the booklet discusses. More than 100 examples are mentioned.

SALT DISPENSER—A new bulletin describing a device designed for the dispensing of salt in tablet form as a preventative of heat sickness, has been issued by the Mine Safety Appliances Co., Pittsburgh. The various features of the dispenser are described and the application of the device is explained and illustrated.

WIRE SCREEN—International Nickel Co. Inc., 67 Wall street, New York, has issued a booklet on the use of corrosion and rust resistant monel for wire screen and filter cloth. Qualities and characteristics of that metal are given as well as the physical properties, such as strength and rigidity, noncontamination, corrosion and abrasion resistance, etc.

(Concluded on page 112)



Fourteen years of hard service and still "going strong" is the record of several hundred Truscon Alloy Steel Foundry Flasks in a large foundry in Pennsylvania. Repair costs have averaged only $5.00 per year for the entire lot. • Combining light weight with brute strength, Truscon Alloy Steel Foundry Flasks save time in handling, ramming and shaking out, and stay on the job over long periods of time with a minimum of maintenance. • Write for bulletin illustrating typical standard types of Truscon Alloy Steel Foundry Flasks. Special types made to meet any requirement.

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6100 TRUSCON AVENUE • CLEVELAND, OHIO

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ALLOY STEEL FOUNDRY FLASKS

To Cut Costs and Improve Quality

That is our guarantee when a Simplicity Portable unit is installed.

Some of the features that enable us to make such a definite guarantee are: A production size screen with real capacity for fine screening; a low shovel height; a vibrating scrap chute; a sand throwing unit with low cost replaceable steel blades; a special lumpbreaker; a single motor drive; three point suspension on roller bearing wheels; and very sturdy construction throughout the entire unit.

This extremely mobile Simplicity Portable Screen and Sand conditioning unit screens, breaks up sand lumps, mixes and cuts, and then throws the sand out as a clean fluffy product ready for use by your moulders. Write for descriptive leaflet.

Simplicity Engineering Company

Durand, Michigan

For Canada: Waterous Limited, Brantford, Ontario

THE APPRENTICE'S GUIDE BOOK

"Elementary Foundry Technology"

First Edition edited by L. A. Hartley—Second Edition edited and revised by Edwin Bremer and Pat Dwyer, The Foundry, Cleveland

JUST PUBLISHED

• This new and completely revised second edition, is a text designed primarily for foundry apprentices and practical students of foundry operations.

The text conforms to the requirements for instruction as set up in the minimum standards of four year foundry apprenticeship in the United States.

General impression of the field covered may be gathered from the following list of main divisions: Substances and Their Structure; Some Physical Properties; Oxidation, Reduction, and Combustion; Force and Motion; Application of Force; Mechanics and Fluids; Effects of Elements on Iron; Iron; The Cupola; Elementary Problems in Steel Foundry Practice; Foundry Sands; Gates and Risers; Molding Machines; Permanent or Long-Life Molds; Glossary; Bibliography.

375 Pages 6 x 9
132 Illustrations—16 Tables
Indexed

Price: $3.00 Postpaid

The book is sponsored by the National Founders Association Chicago

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Enclosed is $3.00 for which please send, all charges prepaid, one copy of "Elementary Foundry Technology" just published.

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(*Concluded from page* 110)

Four standard and four special weaves in monel and nickel are described and illustrated as are some special shapes, baskets, sieves, strainers and other fabricated articles. Definitions, specifications, tables of mechanical and physical properties and a list of applications complete the booklet.

CRUSHERS—C. O. Bartlett & Snow Co., Cleveland, has published catalog No. 77 giving details of single roll, two-roll and four-roll coal crushers; coke crushers; crushing rolls, swing hammer pulverizers, rotary crushers, disintegrators, ball mills, etc. The booklet contains 44 pages of engineering diagrams, capacity tables, etc.

LIGHTING—Westinghouse Electric & Mfg. Co., lighting division, Cleveland, has published a catalog section describing its lighting unit for extreme service conditions in industrial plants. Included in the catalog are dimension outlines, list prices, and light distribution data on various spacings and mounting heights.

SAND—Industrial sands is the subject of a recent booklet of the New Jersey Sand Co., Millville, N. J. The booklet describes the company's plants and facilities to produce various types of sand. Also included are ten practical sand mixes for gray iron and steel castings and for cores of both types. Grain distribution of the various grades of sand is given.

MICROSCOPES—Medical microscopes and their accessories are treated in a recent bulletin published by the Bausch & Lomb Optical Co., Rochester, N. Y. The various models of medical microscopes are illustrated and described and specifications given. Attachable mechanical stages, inclined eyepiece tubes, microscope illuminators, the substage lamp and the universal lamp are a few of the accessories described in the bulletin.

DISK GRINDING—Norton Co., Worcester, Mass., recently has issued a 28-page booklet on disk grinding, including plate mounted cylinders. The text deals with advantages of disk grinding, mounting conditions, speeds, types of disks available, illustrations and features of the various types together with the fields of application and a table of recommendations for individual jobs.

ENGINEERING MATERIAL—Neoprene, an engineering material with rubber-like properties is described in detail in a new handbook published by the Rubber Chemicals division, E. I. du Pont de Nemours & Co. The publication considers the basic properties, resistance properties, a short history of the material, its many industrial applications and a summary of the method of making the material and its chemical composition.

WIRE ROPE CLIPS—American Hoist & Derrick Co., St. Paul, recently has published an attractive and well-illustrated catalog CCB-2 on "The Importance of Thoroughly Dependable Wire Rope Fastenings." The booklet includes the history of wire rope and wire rope fastenings, a discussion of the various features, illustrations and explanation on the correct method of using the clips, and a list of their industrial applications.

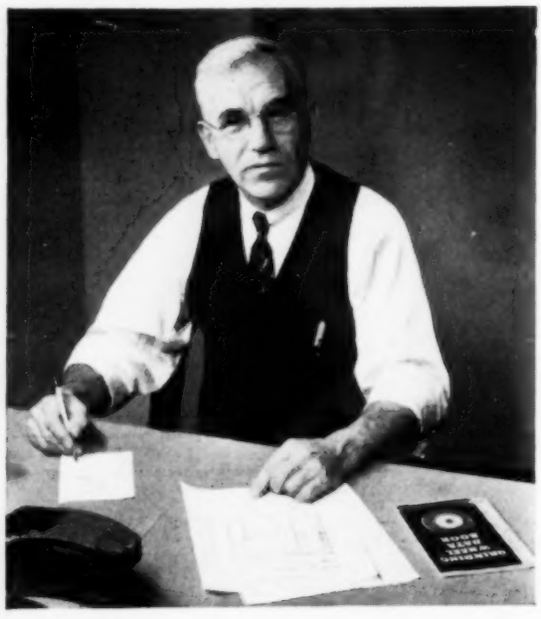
ALLOY STEEL CASTINGS—Vanadium Corp. of America, 420 Lexington avenue, New York, has published a 24-page bulletin containing a description of the properties and applications of a number of vanadium alloy steels for castings where high strength is required without excessive weight or high cost. The booklet is well illustrated with more than 20 photographs of various types of high-strength castings.

TUMBLING MILLS — Whiting Corp., Harvey, Ill., has published a booklet entitled "Cleaning Castings at Low Cost." The booklet includes information on its line of roller bearing tumbling mills, diagrams, cross sectional views, a typical cleaning room layout, standard dimension tables, cloth tube dust filter, etc. Photographs illustrate the various types of roller bearing tumbling mills as well as a number of typical foundry installations.

GENERATING SET—Bulletin 3600-A2, published recently by Fairbanks-Morse & Co., Chicago, describes and illustrates the construction and application of model 36-A diesel generating sets. The text describes the diesel engines in general and engine construction in detail. Generator construction details also are explained as are the alternator construction details. Representative installations of the alternating and the direct current generating sets are illustrated.

PRESSURE INSTRUMENTS—A new 56-page booklet on its line of indicating and recording temperature and pressure instruments has just been published by the C. J. Tagliabue Mfg. Co., Brooklyn, N. Y. The catalog contains information on the company's latest developments, numerous charts, list prices of the various units and complete data on indicating and recording controllers for temperature and pressure, recording thermometers, recording pressure gages and dial indicating thermometers.

CHAIN DRIVES—Morse Chain Co., Ithaca, N. Y. has issued its 20-page 1937 engineering data bulletin No. 49 on silent chain drives. Information includes data on design, horsepower tables, explanation of the different types of silent chains and their applications, layouts of typical shoes and idlers, sprocket data, directions for cutting sprockets, how to calculate chain length, chain cases and methods of oiling. The booklet is well-illustrated with photographs, detailed drawings and special graphs.



What about Grinding COSTS?

LIKE most plant men—you're probably not entirely satisfied with your present grinding figures.

Cost of grinding, though, can often be controlled by investigation of the grinding wheels you use.

Results of recent tests in many users' plants lead us to believe that ABRASIVE COMPANY GRINDING WHEELS can be adapted to your requirements after investigation by our sales engineers so that your costs may be materially reduced.

We will be glad to send specific information at your request.

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GRINDING WHEEL DATA BOOK

Write for your copy of this helpful service book full of practical information about grinding.

DIVISION OF SIMONDS SAW AND STEEL CO.

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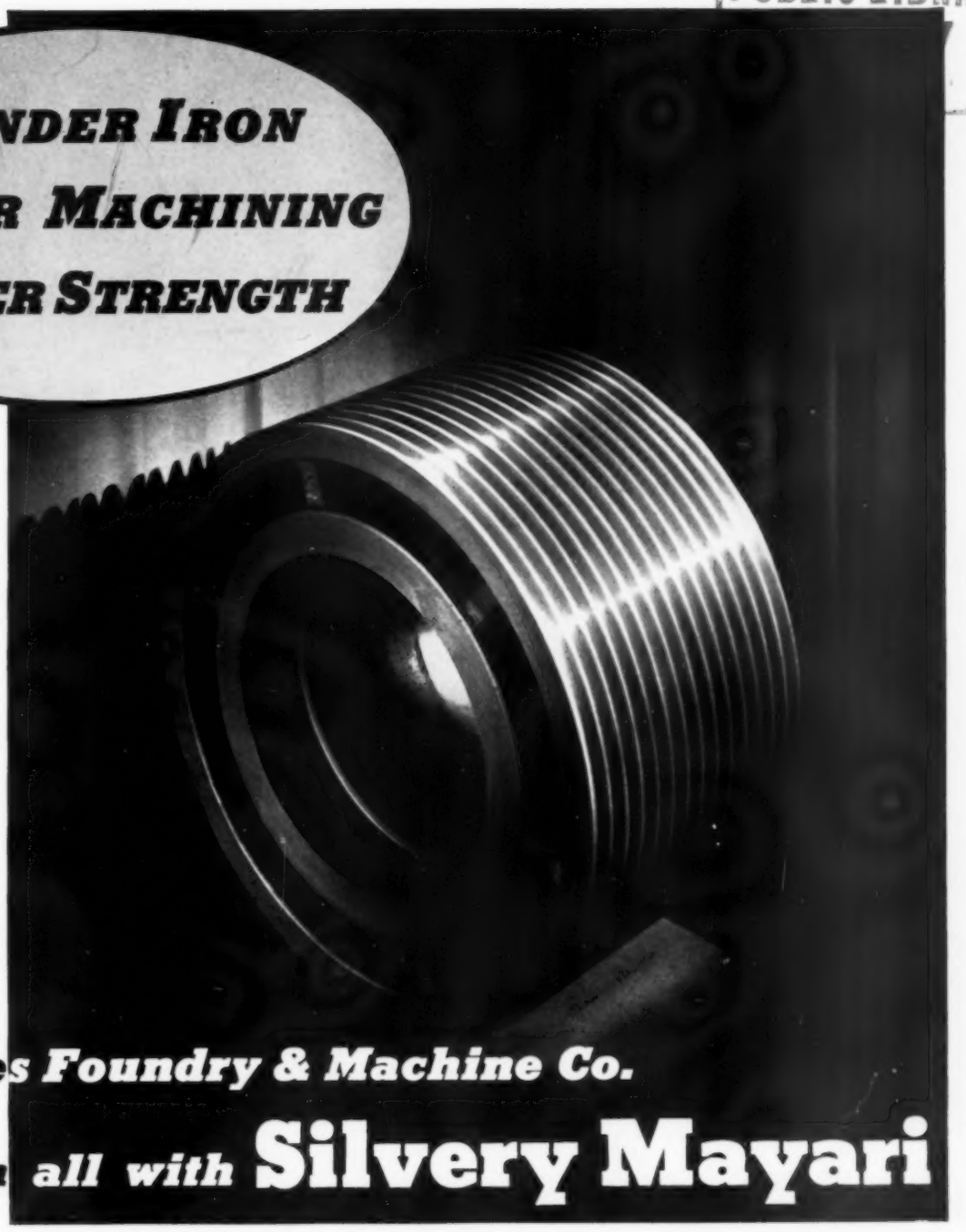
SOUNDER IRON
BETTER MACHINING
HIGHER STRENGTH



W. A. Jones Foundry & Machine Co.

gets them all with Silvery Mayari

W. A. Jones Foundry & Machine Co., Chicago, standardizes on Silvery Mayari in casting rope sheaves where sound iron throughout, high strength and good machining qualities are essential.

These characteristics are the invariable result when cupola mixtures include Silvery Mayari. As a natural alloy iron, Silvery Mayari has an ideal balance of nickel and chromium, is high in silicon and manganese and low in carbon and phosphorus. Its use materially simplifies cupola practice and its fine flowing qualities permit casting a number of different parts from the same mixture.

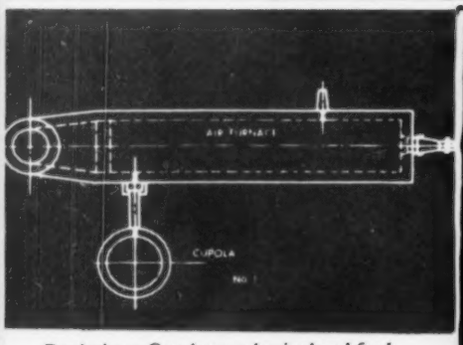
Grain structure in Silvery Mayari castings is dense, uniform, free from segregation or traces of spongy areas. When used in making high-tensile castings a lower T. C. is obtained with a given amount of steel scrap and castings are readily machinable on both thick and thin sections. In addition, an important consideration is the fact that Silvery Mayari permits steel scrap of lower grade to be used successfully.

You will be interested in having a talk with one of Bethlehem's foundry specialists. His suggestions regarding the use of Silvery Mayari in your own business will give you valuable pointers on the economical production of castings that are uniformly high in quality.

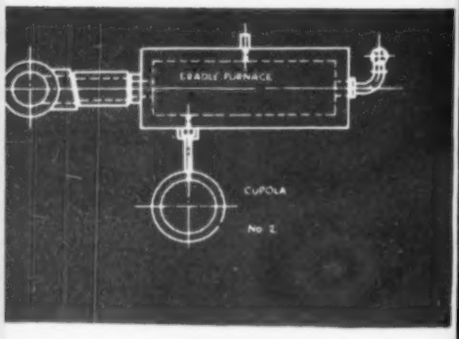
BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY

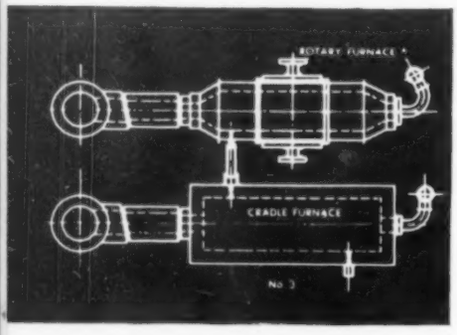
Better Metal at Lower Cost with DUPLEXING



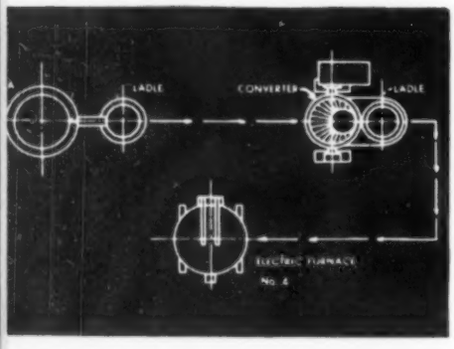
Duplexing—Cupola to pulverized-coal-fired air furnace.



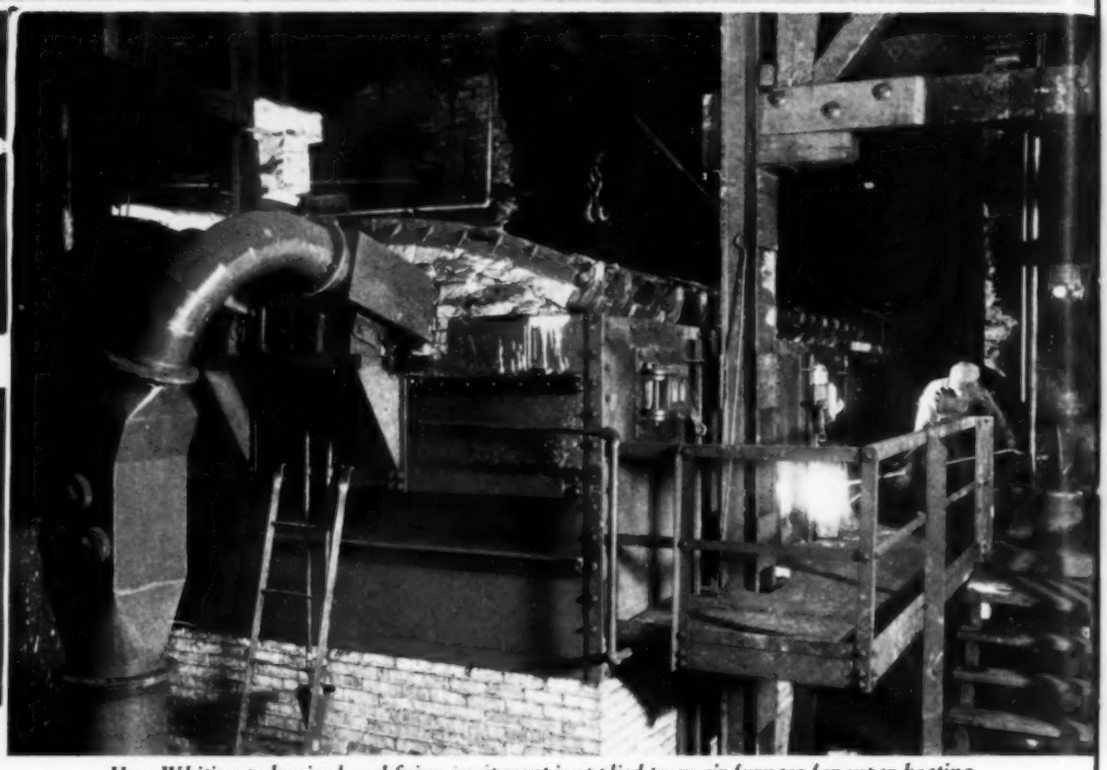
Duplexing—Cupola to pulverized-coal-fired cradle furnace.



Duplexing—Rotary furnace to cradle furnace, both pulverized-coal-fired.



Triplexing—Cupola to side-blow converter to electric furnace.



Here Whiting pulverized coal firing equipment is applied to an air furnace for super-heating and refining the molten iron from the cupola in a large car wheel plant. Burners are water-cooled.

HAVE you considered the possibilities of duplexing for low-cost production of high-quality grey or malleable iron? To meet the greater exactness required by casting users, more and more foundrymen are adopting duplexing methods because duplexing not only gives better control of quality but also lowers cost of production.

Ability to use cheaper materials in original charge, close control of analysis, increased capacity from melting equipment, *ability to pour continuously* and use same flask several times in one day—these are all important advantages which depulexing offers to the modern foundryman.

Broad, practical knowledge of metallurgical processes and equipment gained thru years of experience enable Whiting engineers to co-ordinate various melting units in the duplexing method best suited to individual requirements.

Our engineers will gladly study your problem at your convenience.

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- Cradle Furnaces
- Air Furnaces
- Annealing Ovens
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- Duplexing Equipment
- Ladles—All Types
- Tumbling Mills
- Dust Filters
- Pulverized Coal Equipment
- Seacoal Pulverizers
- Stokers (for Core Ovens)
- Electric Traveling Cranes

WHITING

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